THE ROLE OF SUPPLY, DEMAND AND FINANCIAL COMMODITY MARKETS IN THE NATURAL GAS PRICE SPIRAL

Prepared for

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EXECUTIVE SUMMARY

Background Context of the Study

This report examines the factors underlying the recent upward spiral of natural gas prices. It paints a very different picture than the one we frequently see on television, read in the press or hear in testimony at legislative or regulatory proceedings. The easiest way for all parties to avoid responsibility is to blame tightness in the physical market and invoke Mother Nature – the weather and geology:

- Demand is soaring or skyrocketing.
- Supply is constrained by nature and public policy.
- Financial markets send efficient price signals to balance supply and demand.

This is a simple story, which is often repeated because it is easy to sell; **unfortunately, it is, at best, half true.**

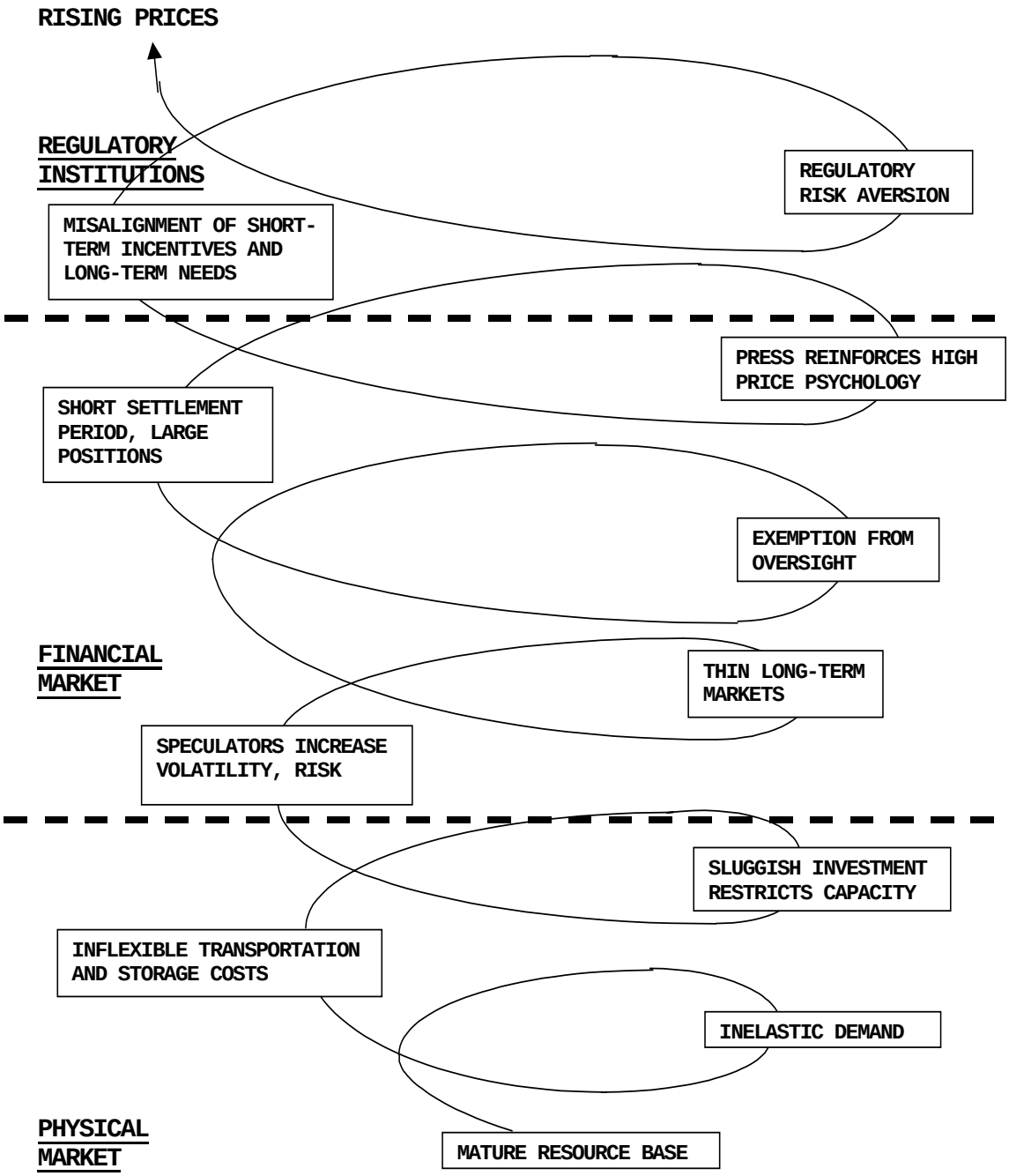
The reality is much more complex (see Exhibit ES-1). Many factors in natural gas physical and financial markets have interacted in an upward spiral to raise natural gas prices to far higher levels than they should be. Although the simple explanation/excuse is easy to tell, the more complex story is just too important not to tell. The frenetic, upward spiral of natural gas prices deeply affects household budgets and economic activity. Consider the following:

- The wellhead price of natural gas in the six-year period of 2000-2005 increased by over **$400 billion dollars** compared to the previous six years.
- Winter heating bills in the Midwest this winter are projected to be up by **$250 per household**, or 28 percent, compared to last winter, despite a 5 percent decline in consumption. They are up by over **$600** compared to five years ago.

If we do not look behind the half-truth, half-hype smokescreen of the headlines, consumers will continue to pay a lot more for natural gas than they should. The public discussion must be expanded to include the other factors that have been powering the upward ratchet of natural gas prices since the start of the 21st century. We must do this not simply because high prices are harmful, but also because specific policy mistakes made in the past have helped to cause the current problems. There are policy measures that can and should be taken in the future to reduce the upward spiral.

Beyond the staggering sums at stake, two fundamental observations provide the background for this analysis:

EXHIBIT ES-1: CAUSES OF SPIRALING NATURAL GAS PRICES



First, the widespread reliance on natural gas commodity markets to set the price paid by consumers is an extremely recent phenomenon, just over 15 years old. As evidenced by the wild, irrational swings in natural gas prices, these new markets have not worked very well. They are deemed to be 'inefficient' in technical academic studies and have a history of manipulation, abuse and misreporting.

Second, natural gas has supply and demand characteristics that make it vulnerable to abuse and volatility, yet the markets in which wholesale natural gas prices are set are less regulated than many other commodity markets. Many in the industry believe these markets lack transparency and are vulnerable to abuse and manipulation. Regulators have failed to lay these concerns to rest because the vast majority of gas trading is subject to little monitoring or oversight. While regulators and policymakers have been scrambling to reform the market rules for this commodity, they have yet to impose comprehensive oversight and accountability.

Physical market fundamentals – a tight supply/demand balance – are not adequate to explain either the short-term or long-term behavior of natural gas prices. This does not mean that tight markets do not matter – of course they do – but identifying physical market fundamentals is only the beginning of the story, not the end.

- Tight markets reflect public policies and strategic behaviors, not just Mother Nature. To the extent that Mother Nature is a wild card, policymakers can and should create systems that are less vulnerable and better able to mitigate the impact of supply shocks.
- Natural gas commodity markets have exhibited erratic behavior and a massive increase in trading that contributes to both volatility and the upward trend in prices. The rules can be changed to moderate these effects.
- The incentive structures and distribution of bargaining power in the physical and financial markets for natural gas are unnecessarily tilted against the consumer. Public policy can and should ensure a better balance.

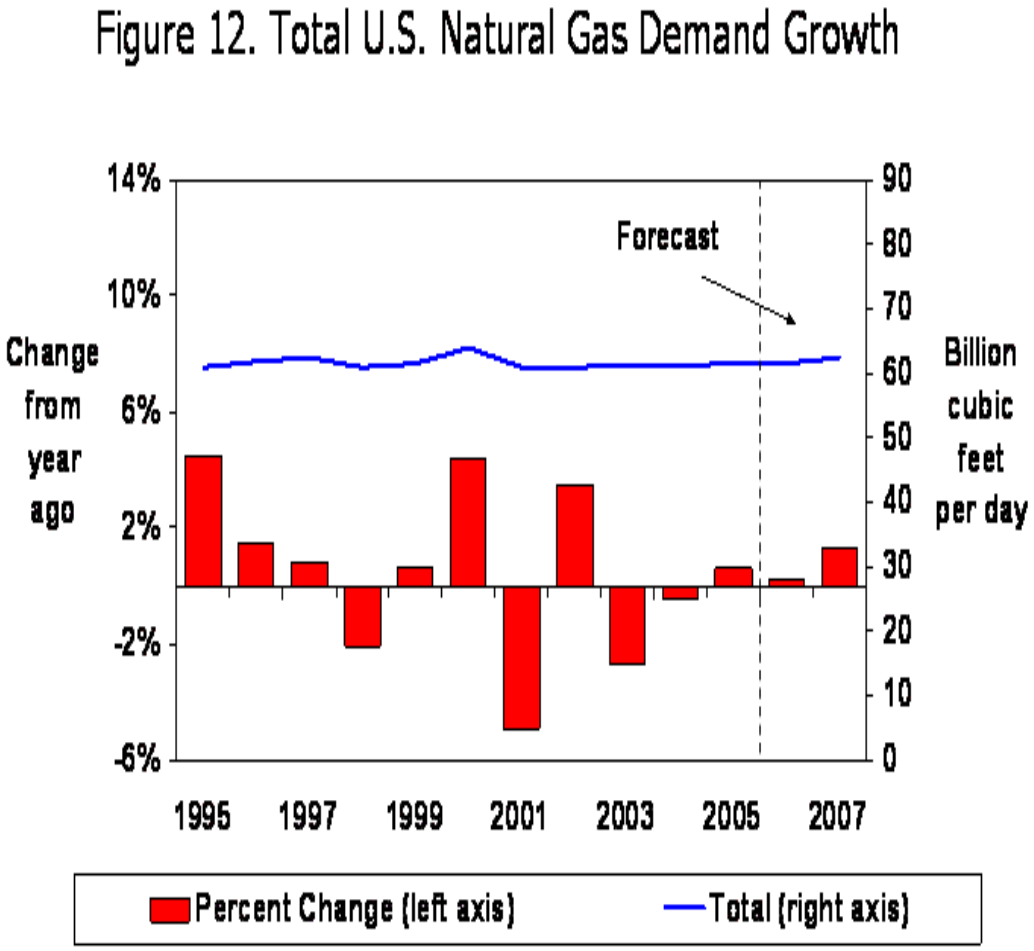
When we look for answers, we end up in Washington, D.C., where jurisdiction over the interstate natural gas system at issue resides. All of the major determinants of the wildly fluctuating price of natural gas in recent years – the physical (wellhead and pipeline) markets and the financial commodity markets – are under federal authority, but policy makers have failed to take the steps necessary to protect the public.

PHYSICAL MARKET FUNDAMENTALS

The long-term fundamentals of supply and demand do not support the current high price of gas.

- Demand has **not** been "surging," "soaring" or "skyrocketing," as is frequently reported in the press (see Exhibit ES-2). Over the past ten years it has been relatively flat, with a slight moderation of the winter peak. Over the past three years, it has declined slightly.

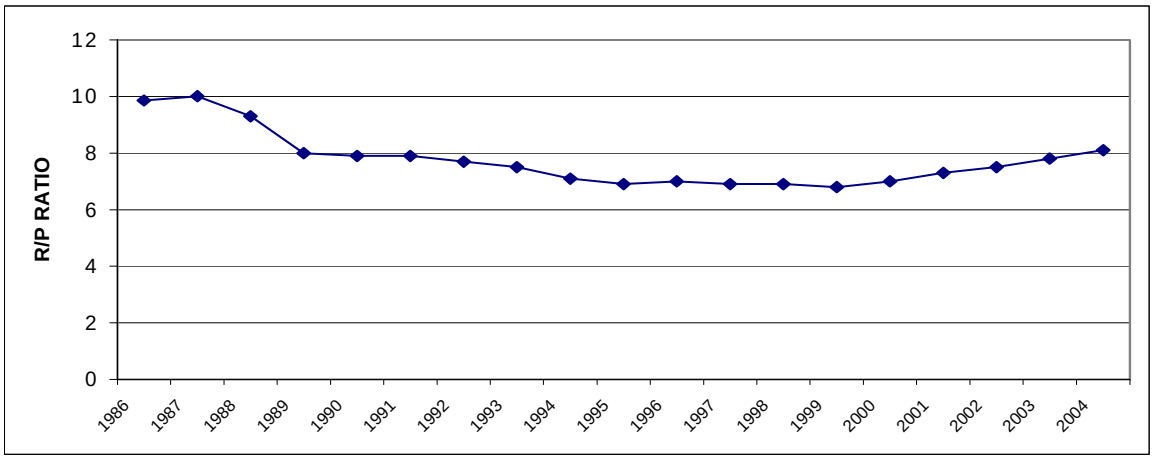
EXHIBIT ES-2: NATURAL GAS DEMAND: 1995-2005



- Although supply reserves were drawn down in the late 1980s and 1990s and have become harder to find, in recent years reserve additions have been growing (see Exhibit ES-3). The reserve-to-production ratio has been increasing for the past six years.
- The long run cost of producing gas (even when using the high-end estimate of such cost) is far below the current price being paid.

Short-term conditions of supply and demand also do not support the current high price of gas:

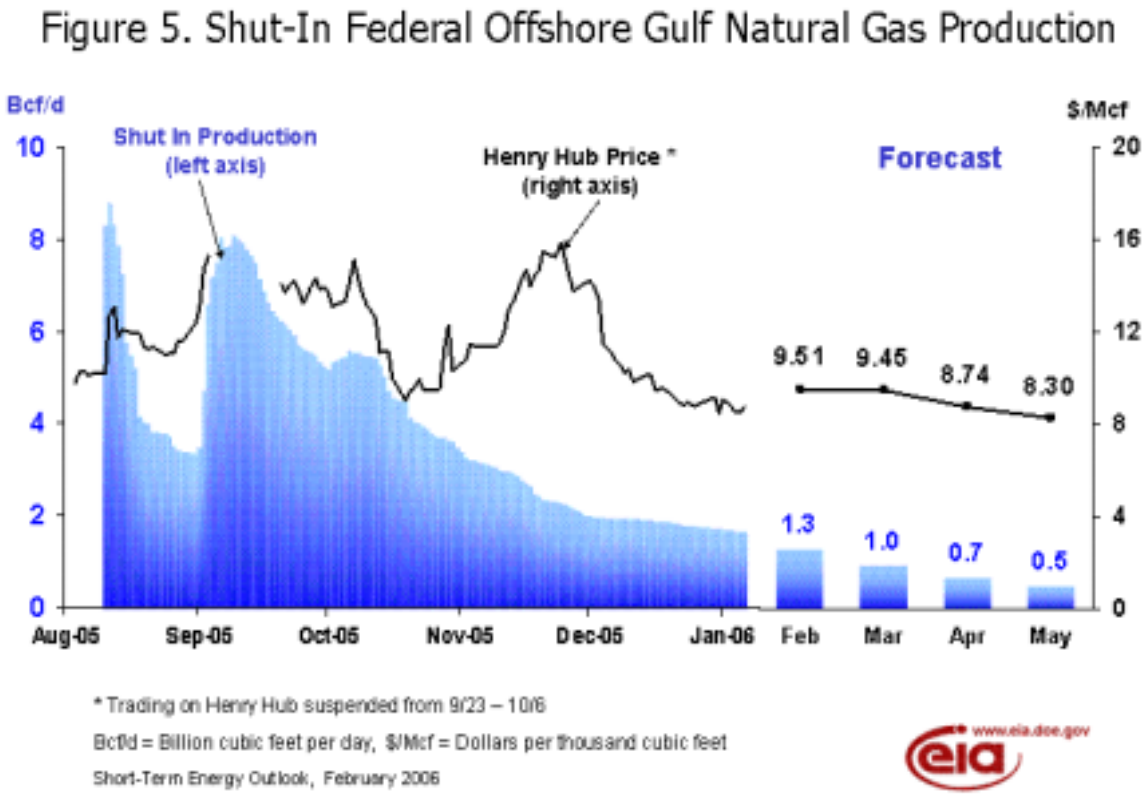
EXHIBIT ES-3: NATURAL GAS RESERVE TO PRODUCTION RATIO



Source: Energy Information Administration, database.

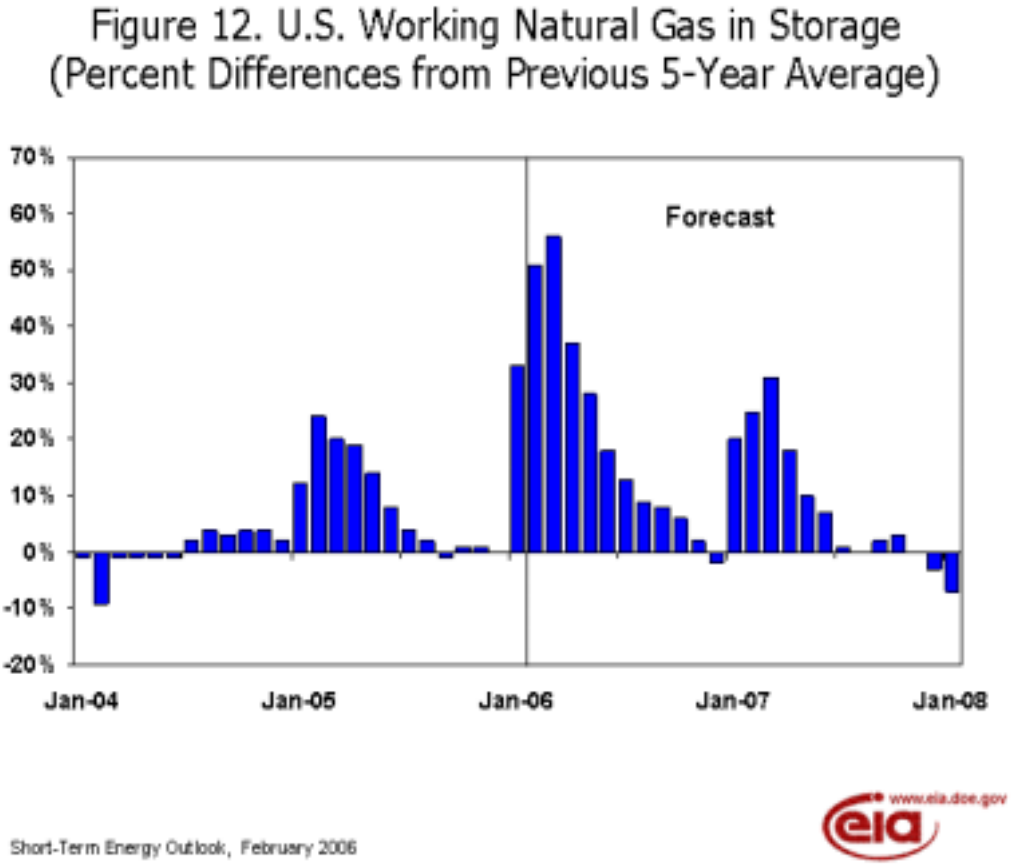
- Notwithstanding the effects of recent hurricanes, supply and demand are now about where they were last year or two years ago (both down a little, with demand down more than supply) (see Exhibit ES-4).

EXHIBIT ES-4: HURRICANES AND PRICES



- Gas in storage is at or near record levels for this time of year, up over 50 percent compared to the last couple of years (see Exhibit ES-5).

EXHIBIT ES-5: DRAMATIC INCREASE IN STORAGE

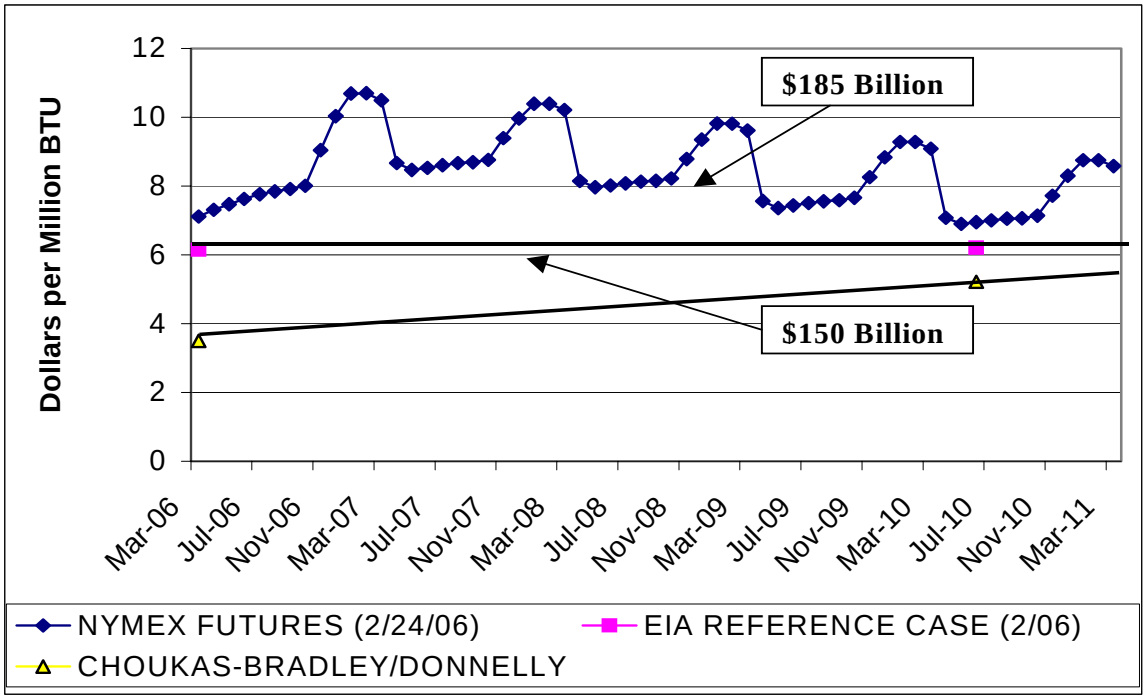


- Traditional supply and demand analysis would suggest that prices should be similar, or even a little lower than they were over the past two years, yet prices are running about $3.00 higher, up over **60 percent** at the wellhead and in the spot market.
- Future prices are even higher still, running about 40 percent above current prices. They are about twice as high as the estimated long run costs of production.

Assurances that things will settle down three or four years in the future are cold comfort. A $3.00 price difference costs consumers about **$5 billion per month**. The massive increases in cash flow enjoyed by the industry in recent years have not been used to expand supply. Sluggish investment keeps supplies tight.

Exhibit ES-6 captures the essence of this concern by contrasting the February 2006 Energy Information Administration (EIA) natural gas projected prices (really production costs) with the futures prices for the next five years, at the settlement of the March 2006 contract

EXHIBIT ES-6: PRODUCTION COSTS VS. SPOT PRICES
(Nominal Dollars)



Sources: NYMEX, 2/24 March 2006 settlement and Futures prices. Energy Information Administration, *Annual Energy Outlook: 200,* p. 155 for gas prices; p. 161 for price indices.

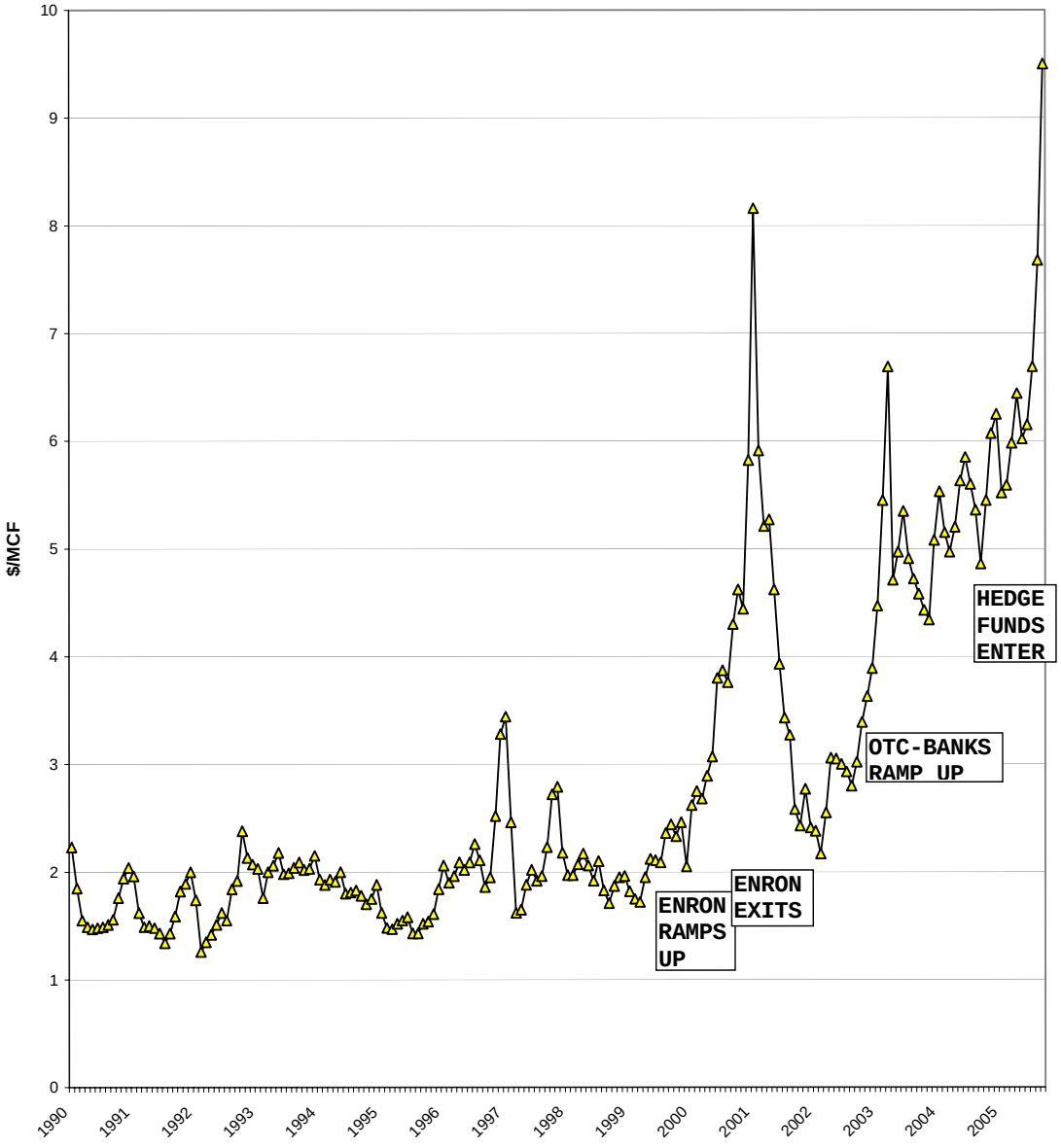
(February 24, 2006). Should the future prices become reality, there is a huge gap between those NYMEX prices and the underlying resource costs of about $185 billion dollars over the five-year period. The stakes are just too high for policymakers to scratch their heads and say, we'll see. The EIA's projection of costs is actually well above other estimates. Thus, the stakes are in the hundreds of billions of dollars.

Financial Markets Compound the Problem

There is a striking correlation between large increases in trading and increases in the volatility and level of natural gas prices (see Exhibit ES-7). Each time trading ramps up, prices ramp up as well. There seems to be a roller coaster and a ratchet. Prices rise rapidly, then decline, but eventually come to rest at a steadily higher base price.

Natural gas trading takes place in unregulated, over-the-counter (OTC) markets and lightly regulated exchanges, like the New York Mercantile Exchange (NYMEX). The physical commodity is traded in some cases – cash transaction – but financial instruments called derivatives that do not involve the transfer of actual ownership of the underlying commodity have become very prominent. There are concerns about both the OTC and the NYMEX.

EXHIBIT ES-7: WELLHEAD PRICES AND CHANGES IN TRADING ACTIVITY



Source: Energy Information Administration, *Natural Gas Database.*

There are several ways in which financial markets may be magnifying the upwardly volatile spiral of prices and contribute to the ratchet:

- Financial markets thrive on volatility and volume, but volatility and volume have costs. Producers of gas demand to be paid a higher premium to bring their gas to market sooner rather than later. Traders demand to be rewarded for the risks they incur, risks that are increased by the trading process itself.
- The influx of traders fuels volatility and raises concerns about abusive or manipulative trading practices.

Econometric analyses of the natural gas markets in recent years raise important questions as to how well the natural gas markets work. Given the uncertainty about the functioning of these markets, the claim that the market price is always "right" because it is the market price should be questioned:

- The economic analysis does not support the claim that these markets operate efficiently to establish prices.
- Risk premiums, which raise the price substantially (10 to 20 percent), are high and rising.
- Prices are well above the underlying costs of production.

The operation of financial markets is no accident. Trading reflects the rules that are established – by law and through self-organization. The most troubling aspect of natural gas trading is that policymakers really cannot decipher what goes on:

- The majority of transactions take place in markets that are largely unregulated.
- These over-the-counter markets, reported in unaudited, unregulated indices, are a major factor in setting the price of natural gas. And these unaudited, unregulated markets have behaved very poorly in recent years, with numerous instances of misreporting of prices.

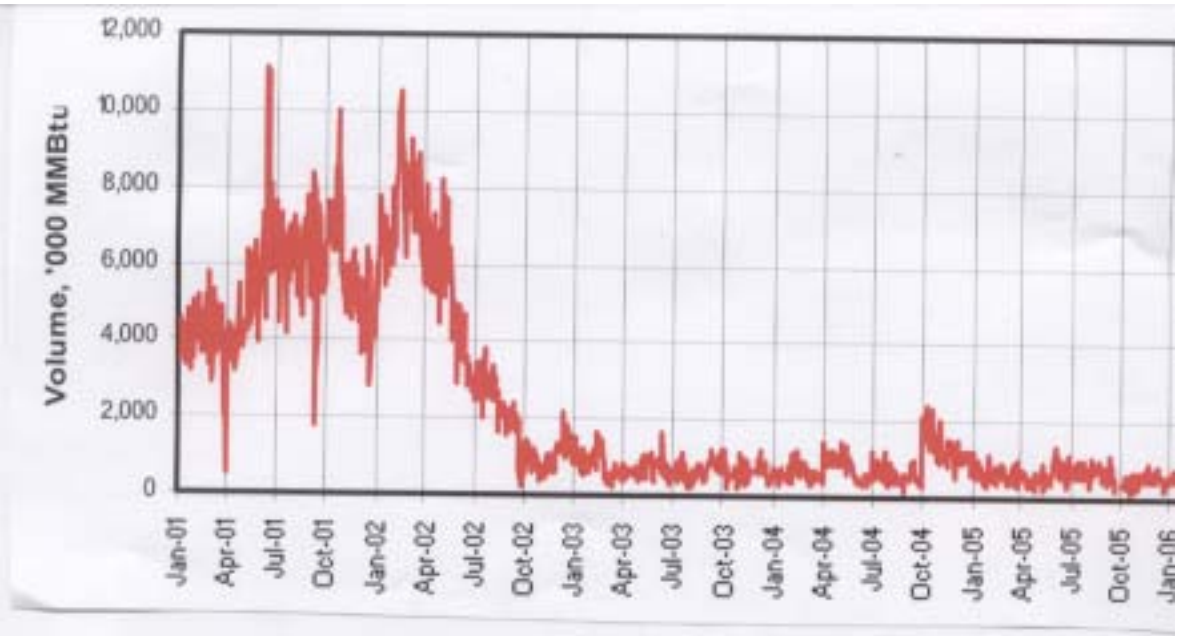
Even where there is light-handed regulation, the rules are inadequate to protect the public:

- A small number of large players can influence the price that consumers pay in a very short period of time and under circumstances that place the consumer at risk.
- Index prices are often based on a small number of self-reported transactions and there are no mechanisms for determining if such transactions represent an accurate sampling of the natural gas market. When even the hint of accountability was imposed by merely being asked to certify the veracity of reported transactions, traders stopped reporting (see Exhibit ES-8). The Exhibit below shows dramatically this phenomenon. The actual volume of trading did not dry up. Only the reporting of the volume did.

Thus, while some may be satisfied with recent market reforms and enforcement efforts, many others are not. The natural gas market lacks the most basic elements of transparency that are necessary to send proper price signals.

- The sad irony is that the markets for natural gas (a commodity which is a vital necessity for many Americans) are subject to far less regulation than most other commodities, most of which are far less crucial to consumers' everyday lives. Most people can live without pork bellies, soybeans or orange juice; but they cannot live without natural gas for heating.

EXHIBIT ES-8: GAS DAILY HENRY HUB REPORTED VOLUME



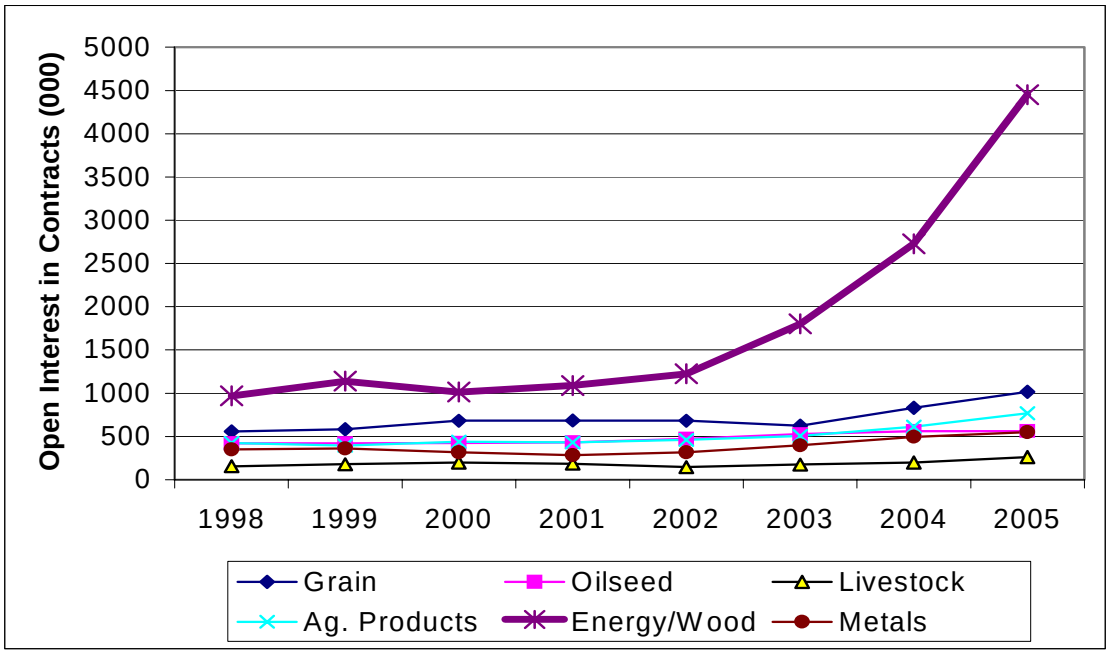
Source: Gas Daily.

Looking at the level of activity in the energy exchanges makes it hard to think that energy is just another ordinary commodity. The massive influx of traders and hedge funds has pumped up trading to astronomical levels. Exhibit ES-9 shows just the increase in the average number of open contracts (i.e. contracts entered into but not yet liquidated by an offsetting trade or physical delivery) at the end of the month over the past eight years. The remarkable growth in energy trading compared to other physical commodities is striking. Even this picture underestimates the increase in energy trading. The dollar value of these trades has increased much faster than the other commodities and off-exchange swaps for the agricultural commodities **are restricted and much less common** except in a very limited number of circumstances. In contrast, unregulated trading plays a very prominent role in natural gas markets.

PUBLIC POLICY

While the story is complex, the bottom line is relatively simple. Things do not have to be this bad and the steps necessary to improve the situation do not involve the usual prescription about biting the bullet until the supply-side comes around. More can and should be done.

EXHIBIT ES-9: COMMODITY TRADING OF NON-FINANCIAL INSTRUMENTS (Average Monthend Open Interest)



Source: Commodity Future Trading Commission, Annual Reports: Futures Statistics by Major Commodity Group.

Over-the-Counter market: Unlike bankers and brokers in organized markets, traders in the over-the-counter market do not have to register or demonstrate their competence or good character. They do not have to report their holdings or positions. They can buy and sell this vital commodity/necessity with little capital or collateral to back up their promises. These markets need better oversight:

- Increased scrutiny could be achieved by requiring that traders in all the natural gas markets register and report their transaction and positions. Traders should be competent and not have a history of abusive trading.
- Natural gas traders should have the resources to meet their commitments and stand behind their trades, as bankers are required to do.
- Regulators should be able to see all markets so they can detect efforts to manipulate or exploit any individual market, including large transactions and large positions.

Exchanges: Even in organized exchanges where natural gas traders have to register, report and show financial and managerial competence, the rules are too lax. Market rules should discourage unproductive trading and be particularly on guard at moments of vulnerability in the natural gas markets:

- This can be accomplished by establishing reasonable limits on positions and ensuring that settlement periods are liquid and long.
- Vigorous oversight and stiff punishment of manipulation and abuse should be meted out swiftly.

Because state policy deals with local distribution utilities, it is difficult to drive change in the system from the buying end, where the primary concern is to make sure consumers have adequate gas to heat their homes. Nevertheless, there are certain measures that state governments can take to address the market concerns:

- States can create pressure for trading reforms by requiring their utilities to deal only with traders who are subject to oversight and who register, report and are audited.
- Mechanisms to promote long-term stability of commitments, transportation, storage and supply should be explored.
- States can also encourage utilities to be more aggressive in holding costs down, but the challenge is to find approaches that do so without exposing consumers to excessive risk.

The position of the major oil companies with large holdings of natural gas physical assets, dominance of natural gas marketing, and active involvement in natural gas financial markets poses a serious threat to consumers. Inadequate investment in exploration over the course of a decade or more contributed to the tight supply conditions. The massive windfall of cash flow in recent years dulls the incentive for the majors to supply gas to the market. They can keep it in the ground and hold out for higher prices. They are under no pressure to sign long-term contracts, except at extremely high prices. As major marketers and traders, they can move markets.

The fact that the majors straddle these markets, several of which are lightly regulated or entirely unregulated, compounds the problem, because their ability to profit by taking contrary positions in various markets is hidden from regulators. Policymakers must have the information necessary to make informed judgments about whether the major oil companies are exercising market power strategically in the long-term, and unfairly exploiting the tight markets they have helped to create in the short term.

A joint task force of federal and state antitrust and regulatory authorities should be formed to examine:

- the regional concentration of natural gas supplies;
- the behavior of the majors as marketers;
- behaviors of the major oil companies across all of the markets in which they are involved in physical as marketers, over-the-counter and in exchanges as traders.

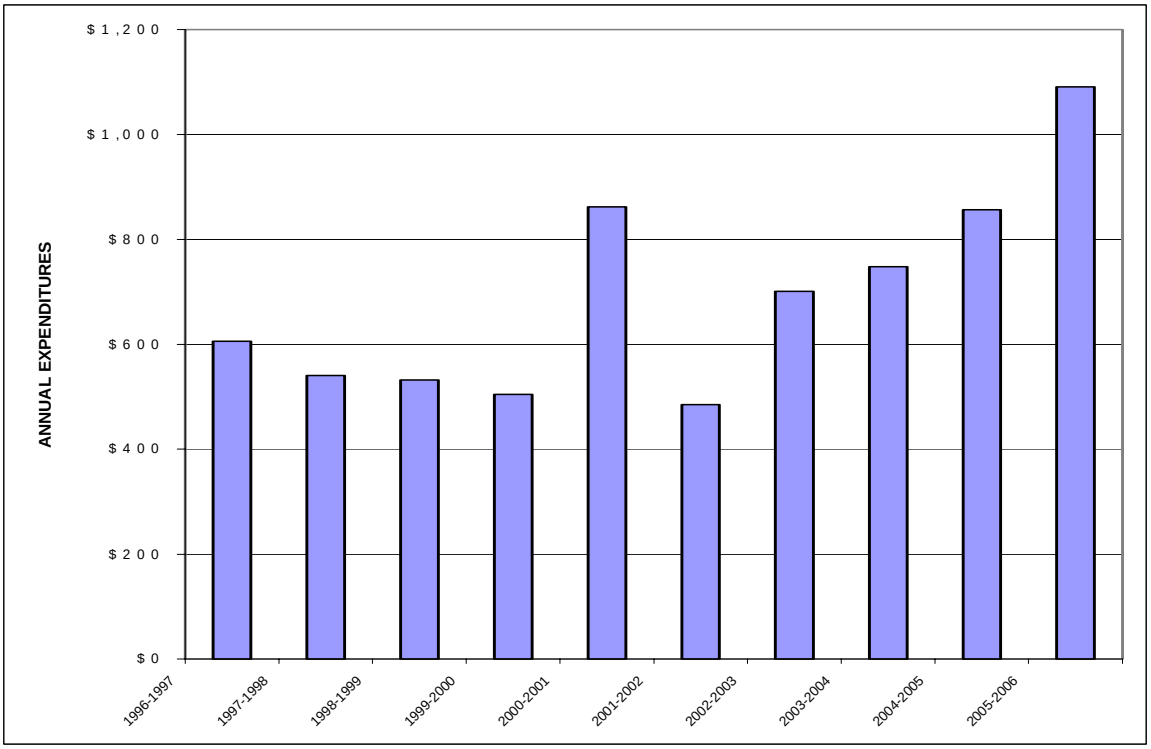
I. HUGE STAKES IN A "WACKY" MARKET

A. Cause for Concern

1. A Staggering Burden

In February of 2006 the U.S. Department of Energy estimated that during the winter of 2005-2006 the typical household in the Midwest that heats with natural gas would face bills that would average about $1100 (see Exhibit I-1). An extremely warm winter kept consumption lower than normal, but the increase in the typical bill is still about $250 compared to the previous winter, and $600 since the winter of 2001-2002.

EXHIBIT I-1: WINTER HEATING BILLS IN THE MIDWEST



Source: U.S. Energy Information Administration, *Annual Energy Outlook*, February 2006 and *Winter Heating Bills*, various issues.

Natural gas cost increases for agriculture and industry, where gas provides not only heat and hot water but is also used as an input and for processing, have been similar. The American Chemical Council, representing the "largest industrial user of natural gas,"[1] expressed

> concern about the sharply rising price of natural gas… Natural gas prices "were sky-high before the storms" – more than doubling since May and up six-fold in the last five to six years. Since the hurricanes, they are up 67%. The U.S. price is the highest in the industrialized world – more than $12/MMBtu [as of late September] and five to ten times the price in some other countries. "U.S. manufacturers simply cannot compete in the global market when the price of a key input is so much higher here."[2]

The impact of the cost increases at the household and business levels has been devastating, but the aggregate sums are even more staggering. In the six years since the turn of the century (2000-2005) the wellhead price of natural gas is up by $400 billion compared to the prior six years (1994-1999). Unlike petroleum products, where a significant part (about 50 percent) of any price increase goes to foreign raw material owners, the overwhelming majority (about 85 percent) of natural gas price increases goes to domestic companies.

2. Wacky, Strange, Odd, Erratic Prices

Prices are not only high; they are also

- " a disaster… a bit of a Gong show," September 23, 2005,[3]
- "out of control," November 18, 2005,[4]
- "unusual," November 30, 2005,[5]
- "wacky," January 25, 2006;[6]
- "frenetic," February 6, 2006[7]
- "strange," February 14, 2005;[8]
- "a roller coaster," February 21, 2006.[9]

While these descriptions in the popular and trade press are striking, the fact that regulators with responsibility for oversight of various parts of the industry described pricing as "odd" and "erratic" at the winter meeting of the National Association of Regulatory Utility Commissioners is a source of even greater concern.[10] Indeed, "the unusual set of circumstances has made it particularly hard for FERC [Federal Energy Regulatory Commission] analysts to draw a clear picture of how markets are truly behaving – and why."[11]

Energy Daily described the pricing patterns that were the source of these observations as follows:

> Several weeks of unseasonably warm weather have left large amounts of gas stockpiled in U.S. reservoirs, pushing prices steadily down to an average of $8.85 per mmBtu during the second week of January.

> According to officials at the Federal Energy Regulatory Commission (FERC) however, that is probably as low as prices will go in the short term.
>
> If true, that would produce an uncommon pattern: gas prices bottoming out in the peak of winter – when gas demand is usually highest for heating – and rising slightly with the approach of spring, typically a period of very low natural gas prices….
>
> Even if gas prices remain soft throughout the winter, however, customers may see only limited benefits from the surprisingly soft gas prices. [12]

From the consumer point of view, the wackiest aspect of $8.85 gas may not be the inversion of winter/spring prices or the lock-in of high prices through hedging, but the fact that $8.85 is considered a "soft" price. Even the continuing decline of spot prices to around $7.00 by mid-February did not really eliminate the consternation. Just four years earlier January gas was selling for about $2.25 per thousand cubic feet (mcf). An additional source of consternation stems from the fact that in the middle of December 2005, the Energy Information Administration (EIA) had revised its estimate for the production cost of gas upward to about $5.50 per million British thermal units (mmBtu).

EIA's estimate, which is considerably higher than the $4.50 estimates of others,[13] suggests that a massive premium, above the full cycle resource costs of production, is being paid for gas. Even more troubling from the consumer point of view is the fact that futures prices are well above the "soft" spot prices (see Exhibit I-2). March 2007 and 2008 prices are over $10.00, twice the cost of production. Hundreds of billions of dollars are at stake.

There should be little surprise, then, that the public urgently wants an answer to a simple question –

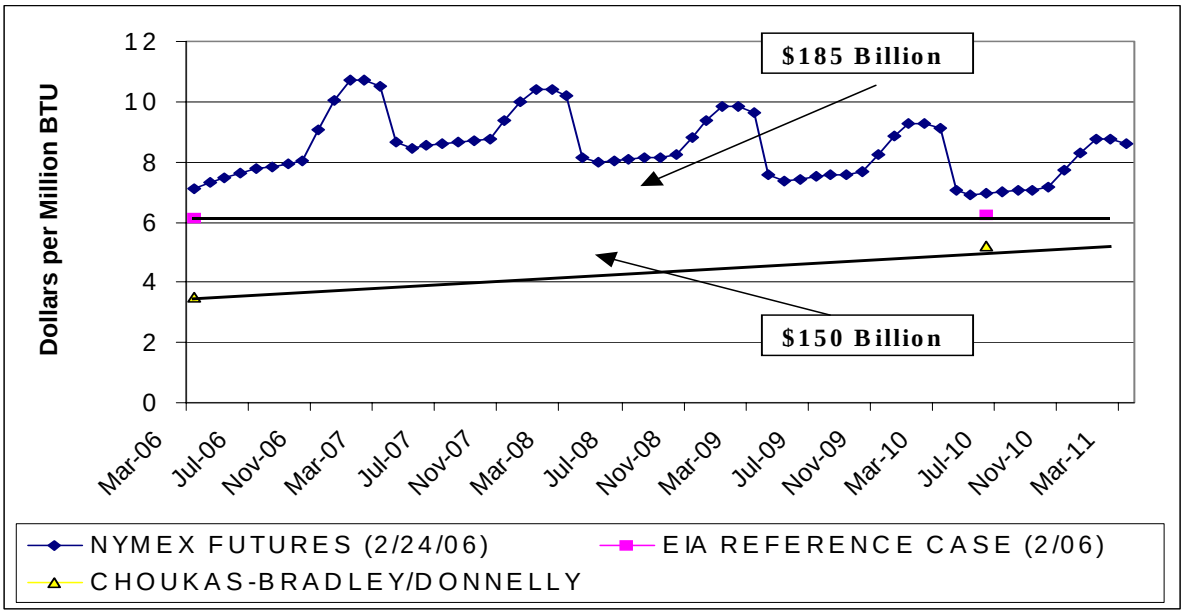
How did this happen?

B. A Complex Spiral of Price Increases

Whenever natural gas prices spike, the major players start pointing fingers. The large oil companies report huge profits and receive a great deal of attention. Tightness in the physical market is blamed. The easiest way for all parties to avoid responsibility is to invoke Mother Nature – the weather and geology.

- Demand is soaring[14] or skyrocketing.[15]
- Supply is constrained by nature and public policy.[16]
- Financial markets send efficient price signals to balance supply and demand.[17]

EXHIBIT I-2: PRODUCTION COSTS VS. SPOT PRICES
(Nominal Dollars)



Sources: NYMEX, 2/24 March 2006 settlement and Futures prices. Energy Information Administration, *Annual Energy Outlook: 200*, p. 155 for gas prices; p. 161 for price indices.

This is a simple story, often told by regulators and in the popular press that is, less than half true. The reality is that a complex spiral of factors has been driving prices to unprecedented and unjustified levels (see Exhibit I-3).

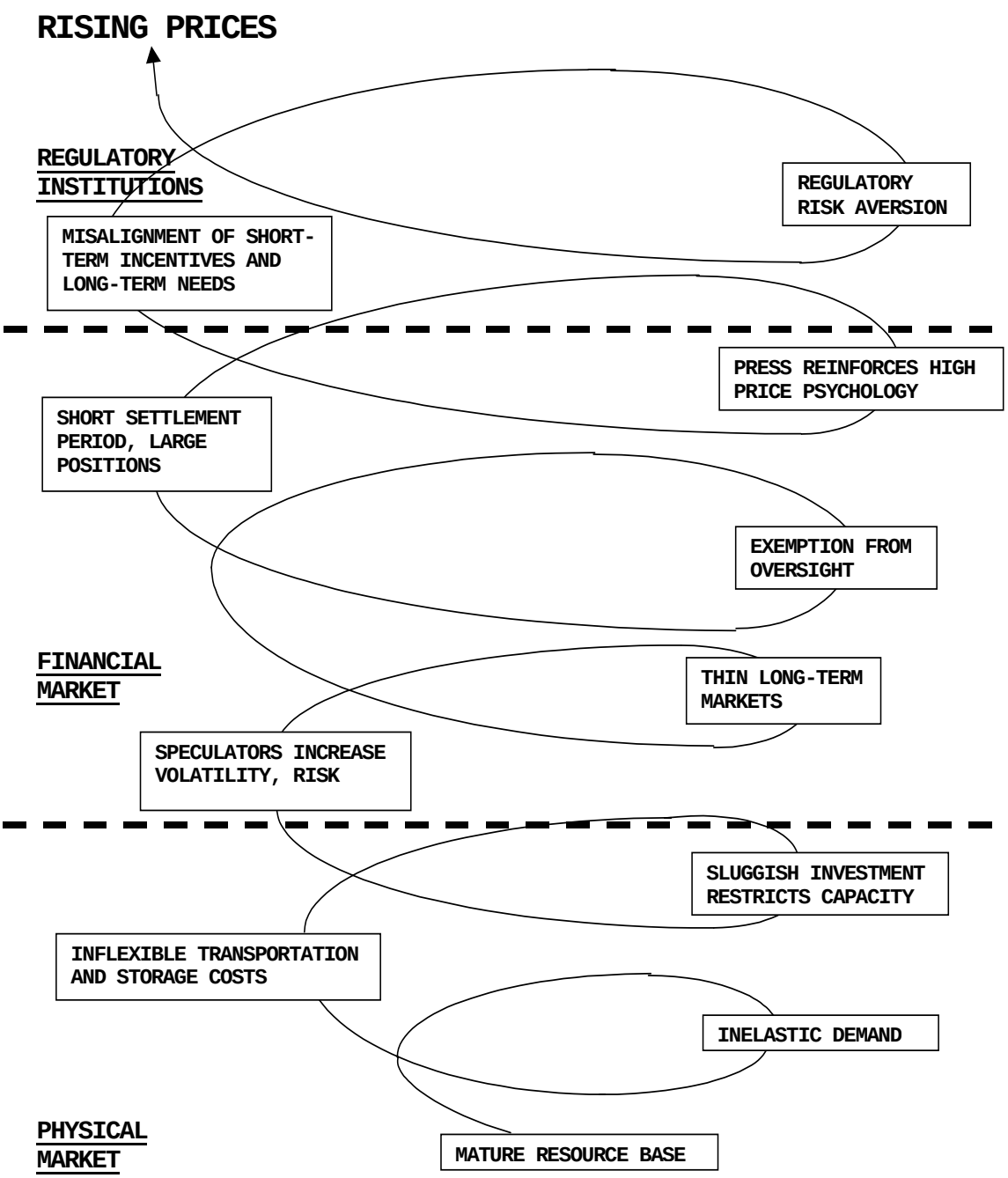
1. Physical Market Fundamentals

Weather certainly affects this market – winter cold, summer heat, hurricanes – but in the past year careful analysis indicates that the weather's divergent effects have largely cancelled each other out. This conclusion stands in stark contrast to news reports that have greatly over-hyped the weather's impact on prices.

- Demand is not surging by any stretch of the imagination. For the past decade, it has been relatively flat.

- The hurricanes that reduced production capacity in the Gulf region, for instance, also shuttered demand, so the loss to the market was smaller than anticipated. Moreover, mild weather in the rest of the country kept demand down, so storage was high and the net available supply had not been sharply reduced. This was clear to anyone who was paying careful attention almost immediately after the events took place.

EXHIBIT I-3: CAUSES OF SPIRALING NATURAL GAS PRICES



Weather can only be a small part of the problem.

Supply is just part of the problem. While it is true that the natural gas resource base is mature, this is more of an excuse than an explanation. In fact, the resource base is stable and the supply-side fundamentals are not consistent with current high prices.

With slowly growing demand, a well functioning market should adapt smoothly. There is no clear picture or consensus on what the production cost of natural gas is in the long term, but it is certainly nowhere near the levels that have been charged at the wellhead in recent months. Moreover, to the extent that production capacity has been tightening, that is not solely the result of geology. It also reflects investment decisions.

2. Financial Commodity Markets

Thus, the story on fundamentals is a lot more complex, and troubling, than the simple "tightness" refrain would suggest. But if physical tightness is not a sufficient answer, what else is driving prices up? There is growing concern that a second culprit, the financial commodity trading markets, may be contributing to high and volatile energy prices.

The *New York Times*, in a recent front-page Business Section article entitled "Energy Trading, Without a Certain E,"[18] described the current activities of energy hedge funds against the backdrop of the impending Enron trials, noting that "some industry officials question whether the funds are contributing to higher energy prices, or at least stoking more price volatility."[19]

While the "E" in the *New York Times* headline was intended to refer to Enron, which is gone but for a few pending fraud trials, it actually could stand for two more important "Es," energy or equity. Huge sums of energy futures contracts are traded without being backed by the underlying assets or equity. Because there are few requirements for backing, entry is extremely easy and trading can escalate rapidly. There has been a stampede of traders into energy markets. As more and more traders and huge sums of money enter the market, there is a concern that the price may be bid up, as suggested by the *New York Times*:

> But with the revival comes questions from some financial market analysts about whether energy trading will be better able to withstand another potential meltdown… The latest ramp-up in trading has also been marked by an air of secrecy underscored by the proliferation of hundreds of hedge funds that are speculating on everything from crude oil to electricity in both regulated and unregulated markets. Many funds are being aided by investment from banks, which are also buying up distressed power plants and other remnants of the collapsed sector.[20]
>
> A debate continues to rage about whether the hedge funds are contributing to higher energy prices. The hedge funds are borrowing as much as 10 times what they invest in some trades, analysts and traders say, contributing to short term

volatility that has complicated the energy purchases of many large energy users.[21]

This quote suggests the complexities of natural gas financial markets. First, large quantities of natural gas are traded in two kinds of markets: over-the-counter (OTC) and on exchanges. "The OTC market refers to a collection of traders, brokers, and other market participants which are interested in a given commodity, security, or derivative, and trade it among themselves and not on an exchange."[22] The OTC market is unregulated. The exchanges are regulated, but many believe that regulation is too lax.

Second, the juxtaposition of hedge funds and large users highlight the distinction between financial instruments (known as derivates) and the physical commodity. A derivative is "a financial instrument, traded on or off an exchange," that involves "the trading of rights or obligations based on the underlying product, but do not directly transfer property."[23]

Third, the quote also highlights the essential characteristic of derivatives. "Unlike their respective underlying commodities… however, derivatives are sometimes preferred as a trading tool for their leveraging capability. Leverage, in financial terms, is the effect of magnifying the outcome of an investment through the use of borrowed funds (credit)."[24]

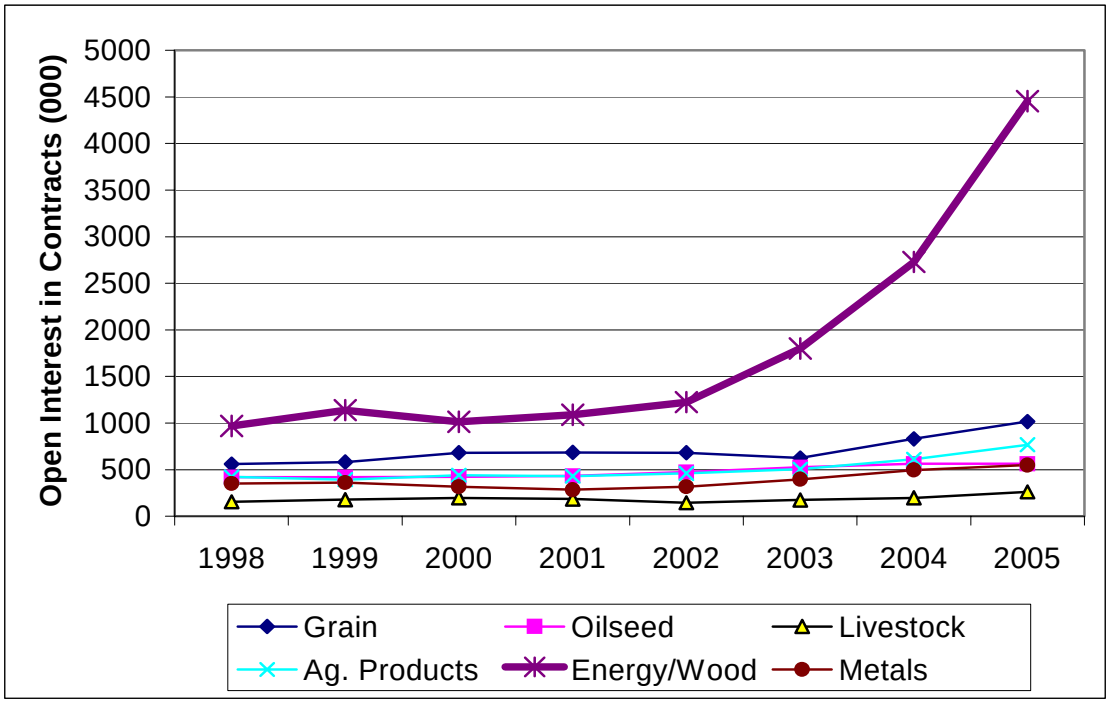
Throughout this analysis the term "financial markets" is used to cover this broad range of markets, transactions and issues. There are policy issues and concerns swirling around exchanges and over-the-counter market, as well as derivatives and the reporting of cash market transaction.

The uniqueness of energy commodity markets can be readily seen in the astronomical level of financial activity that has taken place in these markets (see Exhibit I-4). Month-end open interest contracts as shown in the Exhibit are futures contracts at the end of the month that have been entered into but not liquidated by an offsetting transaction. The amount of open interest in futures on energy at U.S. futures markets (measured in the number of contracts) increased by about 3 million between 2002 and 2005. For all the other non-financial commodities, the increase was just over 1 million.

Even this comparison significantly underestimates the magnitude of the increase in commodity market activity in energies. The dollar value of these energy futures contracts has increased much more rapidly than for other commodities. Moreover, while the off-exchange (or over-the-counter) trading in agricultural derivatives is not significant, that for energy derivatives is.

There are so many plots and subplots in a multitude of settings that it is difficult to present a simple story or know where to begin. We state the obvious when we observe that the physical markets are tight and the financial commodity markets are extremely upwardly volatile. Some people hear the first part – tight physical markets – others hear the second part – volatile financial commodity markets. The real danger may lie in the intersection of the two.

EXHIBIT I-4: COMMODITY TRADING OF NON-FINANCIAL INSTRUMENTS (Average Month-end Open Interest)



Source: Commodity Future Trading Commission, Annual Reports: Futures Statistics by Major Commodity Group.

In the past six years just about everything that could go wrong in the natural gas market has gone wrong.

C. Where to Look for Answers

If the complex spiral of natural gas is the right explanation, then the policy response will have to be complex as well. While policymakers cannot do anything about the weather, they can certainly attempt to build systems that are less vulnerable to and mitigate the impact of uncontrollable events. Physical market and financial market policies that dampen price increases can and should be implemented.

Behind the headlines of high-energy bills and the roller coaster of natural gas prices lies a complex story that is largely hidden from public view. The main action plays out on two large, national stages: the physical market and the financial commodity markets.

When we look for answers, we end up in Washington, D.C. Jurisdiction over the wholesale natural gas system lies squarely in the nation's capitol. Both major determinants of the wildly spiraling price of gas, the physical (wellhead and pipeline) markets and the

financial commodity markets, are under federal authority and that is where the opportunity for fashioning the most critical policies lies.

The state regulatory arena plays a lesser but nonetheless important role because the behavior of utilities, who purchase large quantities of gas for their customers, is influenced by regulatory policy.

Asking the hard questions in Washington does not yield good answers, however, because much of the wholesale natural gas industry is lightly regulated or not regulated at all. Close examination of price behavior and econometric analysis of natural gas market performance suggest that we have no real grasp on how these markets work and a lot of evidence that they are dysfunctional. We certainly do not have the most elementary data on who is playing in the market and how it is being played. The vast majority of energy trading is conducted under circumstances that keep policymakers and regulators in the dark. Thus, regulators cannot answer the most basic questions.

Who is trading and how much?

What are they doing?

What should they be doing?

What should they not be doing?

D. Approach and Outline

Physical market issues tend to receive the greatest attention because consumers see the prices in their monthly bill and the big oil companies, who produce most of our natural gas, post their profits on a quarterly basis. The financial commodity markets receive much less attention because their construction and execution are hard to grasp, while much of their operations are shrouded in secrecy. Many of these players do not have to report their profits publicly and the way these markets affect consumers' energy bills is indirect, although substantial.

When oil companies report profits that are likely to exceed $100 billion this year, it will receive front-page headlines, as past reports of record profits have. But when the commodity market trading shop of a single bank reported a bonus pool for 2005 of $11 billion, the story was buried deep in the business section (if it was reported at all). When hundreds of completely unregulated hedge funds trade hundreds of billions of dollars (perhaps as much as a trillion dollars) of natural gas futures, without ever taking delivery of a single molecule of natural gas, it deserves some attention too, but this activity is hidden behind a veil of secrecy in unregulated hedge funds and trading in over-the-counter derivatives markets. Natural gas may be traded over 30 times before it is consumed (i.e. the volume of trading

exceeds the volume consumed by 30 times), fueling the suspicion that this trading drives up transaction costs and increases volatility.

Therefore, this analysis flips the emphasis around. It views the current situation in natural gas markets and energy markets in general through the lens of change in financial commodity markets. In taking this view, three things are eye catching:

- As noted, although trillions of dollars of transactions take place in these markets, they are largely unregulated in the over-the-counter markets; receiving little regulatory scrutiny, detailed attention in the press, or extensive analysis in academic literature.

- The escalation of trading activity coincides with not only the increase in volatility, but also the upward movement of prices.

- For natural gas these markets are of very recent origin and have a troubled, history. Trading in natural gas futures on the New York Mercantile Exchange (NYMEX), which has become the most influential exchange of its kind, began in early 1990. Large over-the-counter (OTC) trading, ushered in by Enron, began in earnest in 2000, rapidly spun out of control, and quickly crashed. After a period of calm, trading and prices took off again.

The analysis proceeds as follows:

Section II briefly describes the nature of the physical commodity and the fundamentals of the physical market as the context for the operation of the financial markets. The basic characteristics of the commodity affect the nature of its production, distribution and use, as well as set the context for financial markets. It begins by discussing the characteristics that make energy commodities vulnerable to price spikes, exploitation and manipulation. It shows that demand has been steady, but investment in supply has been sluggish. Examining estimates and projections of the cost of production, it finds that the current prices are well above long-run economic costs. It also demonstrates that the current short-run supply situation does not justify the high prices. In sum, while the tight supply-demand situation accounts for some of the recent increases in price, prices are far above where the physical fundamentals suggest they should be.

Section III examines the movement of natural gas prices in the financial markets. It recounts the history of natural gas prices over the last decade and a half, pointing out the coincidence between prices, trading, and public policy decisions. It describes this history in two acts. The first covers the period from the beginning of natural gas trading through the collapse of Enron. The second covers the resurgence of commodity trading after a period of post-Enron quiet. The massive abuse of the Enron era is gone (we hope) but prices are still "wacky." Recent experience suggests that problems in the natural gas market persist, beyond the fraud that occurred during the Enron period. The section then discusses factors that may move prices in natural gas markets.

Section IV presents a discussion of uncertainties and doubts about the behavior of natural gas markets based on academic and trade analyses. It reviews general, theoretical concerns, as well as the academic literature of concerns about financial markets. It concludes with an examination of anecdotal and academic evidence of anomalies in the natural gas market.

Finally, Section V offers recommendations for policy-oriented examination and reform of natural gas market.

ENDNOTES

[1] Foster Report, No. 2560, September 29, 2005, p. 5).
[2] Id.
[3] Platts, *Gas Daily,* September 23, 2005, p.
[4] Platts *Gas Daily,* November 18, 2005, p. 2.
[5] Chernoff, Harry, "Unusual Signals form the Natural Gas Markets, *Energy Pulse*, November 30, 2005.
[6] Beattie, Jeff, "Warm Winter Brings Wacky Price Pattern to Natural Gas Market," *Energy Daily,* January 25; see also Platts *Gas Daily,* February 14, 2006, p. 2.
[7] Platts, *Gas Daily,* February 6, 2006.
[8] Platts, *Gas Daily,* February 14, 2006, p. 3.
[9] *Wall Street Journal,* February 21, 2005, p. C-1; see also Platts, *Gas Daily,* February 6, 2006, p. 2.
[10] Beattie, "Wacky," p. 1.
[11] Platts *Gas Daily,* February 14, 2006, p. 3**.**
[12] Beattie, "Wacky," pp. 1…4.
[13] Energy Information Administration, *Annual Energy Outlook: 2006,* February 2006; Choukas-Bradley, James R. and Michael Donnelly, *A Report on Projected Natural Gas Prices and Dynamics of the Natural Gas Market for 2005 and Beyond,* February 11, 2005.
[14] David J. Lynch, "Natural Gas Treads a Global Path: USA's Soaring Use Means Growing Reliance on Imports – which, If Handled Well, Could Mean Lower Prices," *USA Today,* December 20, 2005, A-1.
[15] Fischer, Ben, "Fueling the Fire," *Wisconsin State Journal,* February 12, 2006, p. C-6.
[16] Federal Energy Regulatory Commission, *High Natural Gas Prices: The Basics*, February 1, 2006.
[17] Brown-Hruska, Sharon, *Crisis Regulation: Reacting to High Energy Prices*, before the University of Houston Global Energy Management Institute, January 26, 2006.
[18] Alexei Barrionuevo, "Energy Trading, Without a Certain 'E'," *New York Times*, January 15, 2005, p. 3-3.
[19] Id., p. 3-3.
[20] Barrionuevo, "Energy Trading," p. 3-3.
[21] Id., p. 3-3.
[22] Sturm, Fletcher J., *Trading Natural Gas* (Tulsa: PennWell Publishing Company, 1997).
[23] Commodity Futures Trading Commission, *A Glossary.*
[24] Sturm, p. 31.

II. PHYSICAL MARKET FUNDAMENTALS CREATE A VULNERABLE COMMODITY

To tell the complete story of natural gas prices we must understand the problems in the physical market and how they interact with financial markets. The analysis of the financial commodity markets must proceed within the context of the general nature of the commodity.

Energy commodities in general, and natural gas in particular, are produced and delivered under conditions that make them UNIQUE. Some of the practices and institutions that might be appropriate or acceptable for other commodities do not fit the situation of natural gas. The physical conditions of supply and demand interact powerfully. This is true for both "market forces" and behaviors that seek to manipulate or move markets. As the author of a comprehensive economic theory ABOUT manipulation of commodities noted, "the profitability of manipulation varies with certain structural variables, such as transportation costs, demand and supply elasticities, commodity flows, storage costs, and intertemporal consumption preferences."[1]

In the natural gas market, a number of structural variables are arrayed to the disadvantage of the consumer. Some of these structural variables are inherent in the nature of the technology of finding, delivering and using the commodity. Some of the structural variables are directly the result of public policy choices and strategic actions.

Basic conditions on the supply-side of the physical market include the low elasticity of supply and important sources of friction in the delivery of the product – high transportation and storage costs, as well as constraints on transportation and storage options. Basic conditions on the demand-side include a low elasticity, lack of substitutes, and a strong seasonality of demand. Market structural conditions that reflect public policy include concentration and the ownership of the commodity by large traders, as well as institutional factors that constrain actions by important market participants. This section examines the physical market, starting from the burner tip (demand) and working back through the delivery infrastructure to the wellhead (supply).

A. Demand

1. Consumption

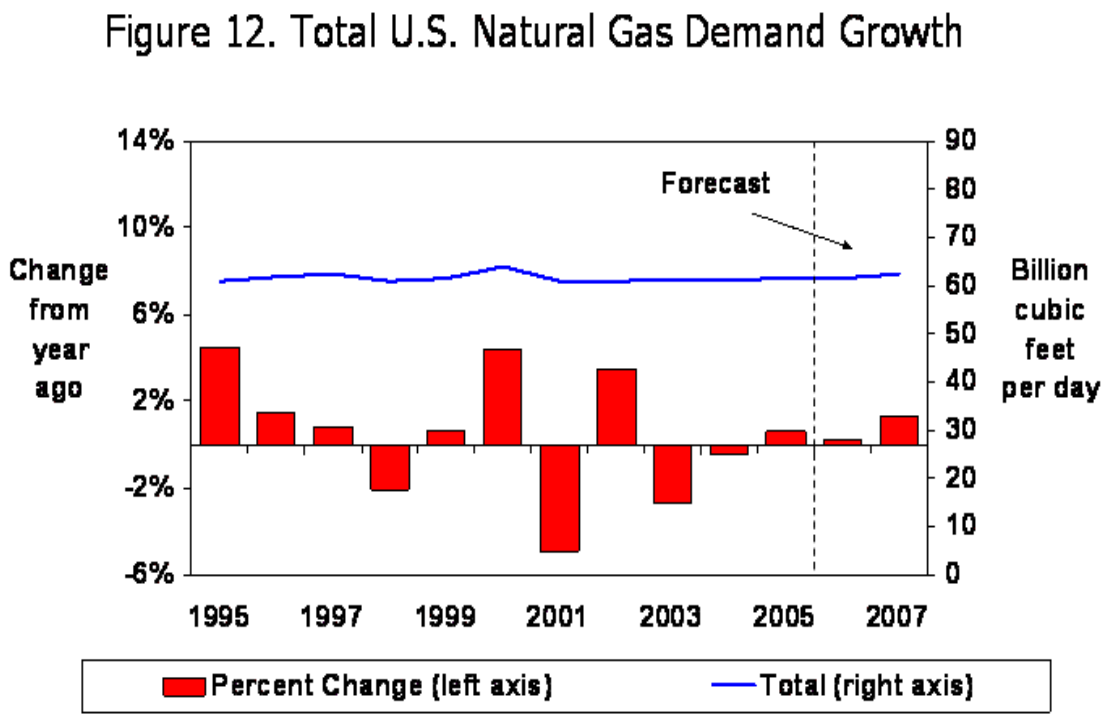
A tight market for a commodity like natural gas is dangerous for consumers. Natural gas is a vital necessity, which means that it has a low price elasticity of demand and a moderate-income elasticity of demand. As the price rises, it is very difficult for consumers to cut back and they suffer a loss in welfare as the cost eats up a larger part of their income. Residential consumers use natural gas primarily for heating and, increasingly, indirectly for electricity. Demand is generally predictable in a seasonal pattern. The amount consumed by

residential users is dictated in large part by the kinds of buildings in which they live and work and the energy efficiency of the appliances they use. Natural gas is a feedstock for industrial uses for which substitution is difficult, at best. Natural gas has been the fuel of choice in the electricity industry for about a decade, particularly for facilities to meet peak demand. This increased consumption by gas-fired generating plants shifted the pattern of demand more heavily into the summer months. As a result, it has become more expensive to put gas in storage in preparation for the winter heating season.

Demand is quite inelastic – large increases in price elicit small changes in demand. Short-term elasticities are in the range of -0.3; long-term elasticities are in the range of -0.6 and less than one in the aggregate.[2] What this means is that a ten percent increase in the price of gas results in a 3 percent decline in demand. The low elasticity of demand is the critical factor in rendering the energy market volatile and vulnerable to manipulation.

The elasticity of demand is also important in another respect. It underlies the pattern of demand growth across time. Demand has been flat, at most growing slightly over the past decade (see Exhibit II-1). There has also been a slight dampening of the seasonal pattern as more gas is consumed during summer months to generate electricity.

EXHIBIT II-1: NATURAL GAS DEMAND: 1995-2005



The misimpression of soaring demand may have been created by the building of natural gas fired electricity generating plants. While use in this sector did increase, the use of gas did not for at least three reasons. First, some of the more efficient new gas-fired plants displaced older, inefficient gas-fired plants. Second, some of the new plants did not fire-up much because of their high operating costs. That is why they are being sold as distressed assets. Third, there has been a great deal of demand destruction in the industrial sector.

The shift form industrial load to natural gas-fired plants shifts load to the summer, which may make it harder to find gas to put into storage. Summer was a slack period. In this sense, it is filling the valleys. The shift in demand may also shift the need for physical facilities to transport gas new locations. The image of "soaring" demand for gas to be consumed at the burner tip as the cause of the sharp price-run up price is simply wrong. Soaring demand in terms of hedge funds and speculators expanding their trading of gas contract as a cause of the price increase is being fiercely debated.

The most recent short-term energy outlook from the Energy Information Administration makes this point quite clearly. The past three years, which have seen the most dramatic increase in prices, have had a net decline in consumption. The claim of surging demand cannot be squared with reality. The response to the price increases of recent years has been inelastic – a very small reduction in the face of a very large price increase.

2. Distribution Infrastructure

Supply is equally inelastic, with long lead times needed to find and develop resources and the capital-intensive infrastructure (pipelines and storage facilities) to deliver it. Transportation and storage are expensive and difficult. Because natural gas is consumed in large quantities, huge sums of money can change hands very quickly as the price rises.

Many sources of energy are located far from consumers, requiring transportation over long distances. Energy supplies are expensive to transport and to store. Because of the nature of the underlying molecules, the production, transportation and distribution networks are extremely demanding, real-time systems. These systems require perfect integrity and real-time balancing. Transportation, storage and distribution infrastructure is extremely capital intensive and inflexible, relying on networks that are sunk in place with limited ability to expand in the short and medium term because of long lead times to build.

These physical and economic characteristics render the supply-side of the market inelastic.[3] Unlike financial instruments, which are simply pieces of paper that can be stored or moved with extreme ease, energy commodities are difficult and costly to move and store. Physical transactions involve a great deal of friction. This is the critical factor in the financial market.

> Economic frictions (including transportation, storage, and search costs) which impede the transfer of the underlying commodity among different parties

> separated in space or time can create the conditions that the large trader can exploit in order to cause a supracompetitive price.[4]

Given the basic infrastructure of supply in the industry, the availability of excess capacity and stocks to meet changes in demand is the critical factor in determining the flexibility of supply. "All else equal, the lower the storage costs for a commodity, the more elastic its demand."[5]

One recent study found the volatility of natural gas prices to be greater than oil prices because of the nature of the infrastructure required to deliver natural gas to consumers:

> The dependence of natural gas on more inflexible sources of supply and the greater role of transportation opens the window to profiteering. It appears that volatility in natural gas returns is more persistent than volatility in oil returns. By itself, this result suggests that there may be a "larger window of profit opportunity" for investors in natural gas than in oil….
>
> [N]atural gas return volatility responds more to unanticipated events (e.g. supply interruptions, changes in reserves and stocks, etc.), regardless of which market they originate in.[6]

The bottom line is that the existence of friction and volatility opens the door to profit opportunities. "If prices and thus returns rise in response to volatility, there may be immediate profit opportunities in natural gas following shocks in either market."[7] These opportunities attract traders to enter the market and give those in the market an incentive to exploit the frictions and shocks.

Because natural gas is a physical commodity that is actually consumed (unlike a pure financial instrument), is difficult to store and expensive to transport, natural gas markets are complex. A recent book entitled *Energy Risk* identifies the uniqueness of energy markets, comparing energy commodities to more pedestrian financial instruments like stocks and bonds. The key elements identified are the supply-side difficulties of production, transportation and storage, and the demand-side challenges of providing for a continuous flow of energy to meet inflexible demand, which is subject to seasonal consumption patterns.

> [T]he deliverables in money markets consist of a "piece of paper" or its electronic equivalent, which are easily stored and transferred and are insensitive to weather conditions. Energy markets paint a more complicated picture. Energies respond to the dynamic interplay between producing and using; transferring and storing; buying and selling – and ultimately "burning" actual physical products. Issues of storage, transport, weather and technological advances play a major role here. In energy markets, the supply side concerns not only the storage and transfer of the actual commodity, but also how to get the actual commodity out of the ground. The end user truly consumes the asset. Residential users need energy for heating in the winter and

> cooling in the summer, and industrial users' own products continually depend on energy to keep the plants running and to avoid the high cost of stopping and restarting them. Each of these energy participants – be they producers or end users – deals with a different set of fundamental drivers, which in turn affect the behavior of energy markets…
>
> What makes energies so different is the excessive number of fundamental price drivers, which cause extremely complex price behavior.[8]

A recent article in an investor newsletter under the headline "Investors Beware" offered a strong warning about the uniqueness of energy commodities. "There are four fundamental characteristics of energy markets that investors must understand before investing in energy: 1. Valuation is more challenging, 2. Data is less transparent, 3. Energy is more volatile, 4. Trades are more operationally complex."[9]

Complexity of physical characteristics translates into a highly vulnerable product in this commodity market.

> Although the formal analysis examines transportation costs as the source of friction, the consumption distortion results suggest that any friction that makes it costly to return a commodity to its original owners (such as storage costs or search costs) may facilitate manipulation.
>
> The extent of market power depends on supply and demand conditions, seasonal factors, and transport costs. These transport cost related frictions are likely to be important in many markets, including grains, non-precious metals, and petroleum products.
>
> Transportation costs are an example of an economic friction that isolates geographically dispersed consumers. The results therefore suggest that any form of transactions cost that impedes the transfer of a commodity among consumers can make manipulation possible. [10]

B. Supply

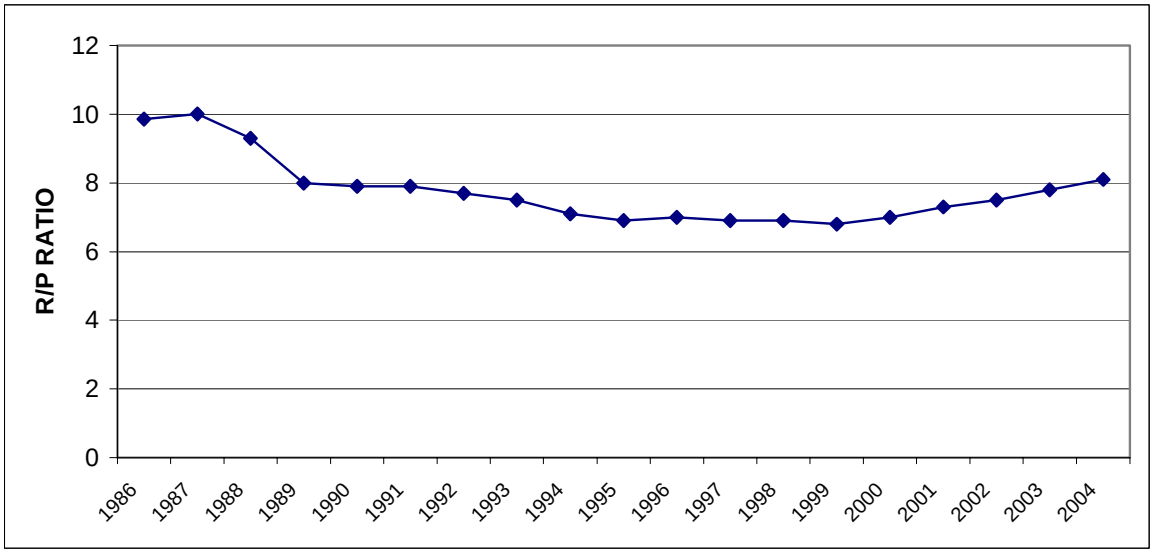
1. Reserves and Resources

Tightness of supplies in the physical market plays a role, but why supplies are so tight, how long that will last and how high prices should be as a result are hotly debated. At present, consumers are paying excessive prices far above the cost of production."[11]

The trend of demand is hardly a shock and most markets are equipped to handle it well. Thus, the physical market problem, if there is one, is on the supply-side. Although the resource base in the U.S. is "mature," it has certainly not collapsed or dried up. The market became tight primarily because the supply side resource did not keep up with production.

As Exhibit II-2 shows, throughout much of the 1980s and early 1990s, reserve additions failed to keep pace with production. In the mid-1990s, additions to reserves equaled production. In the past five years reserve additions have exceeded production, although that has come about from extensions of existing fields rather than finding new ones. Can these modest changes in physical fundamentals account for a quadrupling of price in such a short period of time?

EXHIBIT II-2: NATURAL GAS RESERVE TO PRODUCTION RATIO

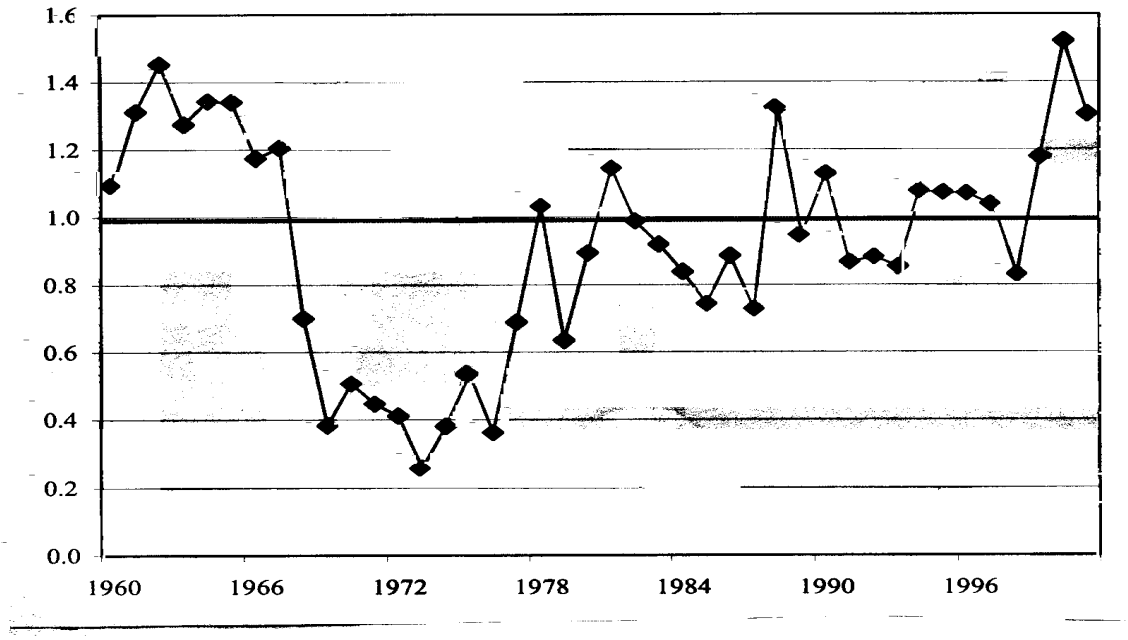


Source: Energy Information Administration, database.

Long-term trends do not suggest a major change. For example, the Stanford Energy Modeling Forum points out that the long-term trend of reserve replacement is not consistent with the extremely pessimistic view taken by the industry (see Exhibit II-3). Similarly, the most recent report of the Potential Gas Committee, which has been analyzing the natural gas resource base for a quarter of a century, does not suggest such a gloomy picture. The biennial report of the Potential Gas Committee of September 2005,

> shows total probable, possible and speculative traditional gas resources of 950.0 Tcf and another 169.3 Tcf of potential coalbed gas resources in the U.S. (including Alaska)…. That is the equivalent of 68 years of production at current rates, and represents nearly the same total reserve base estimated in 2002….
>
> "The 2004 assessment reaffirms the Committees evaluation of an abundant U.S. natural gas resource potential," said John Curtis, Director of the Potential Gas Agency at the Colorado School of Mines, which provides guidance and technical assistance to the PGC…

EXHIBIT II-3: NATURAL GAS REPLACEMENT RATE (=Additions/Production)



Source: Energy Modeling Forum, *Natural Gas, Fuel Diversity and North American Energy Markets*, September 2003, Figure 2.

> The size of the resource base today remains roughly the same as estimated in the committee's year-end 2002 numbers, but 38 Tcf of natural gas was drawn down since that time. Factoring in the past two years' production, PGC has increased its estimate of the U.S. gas resource base with each successive report over the last 12 years or more.[12]

2. The Industry Flip-Flop on Price

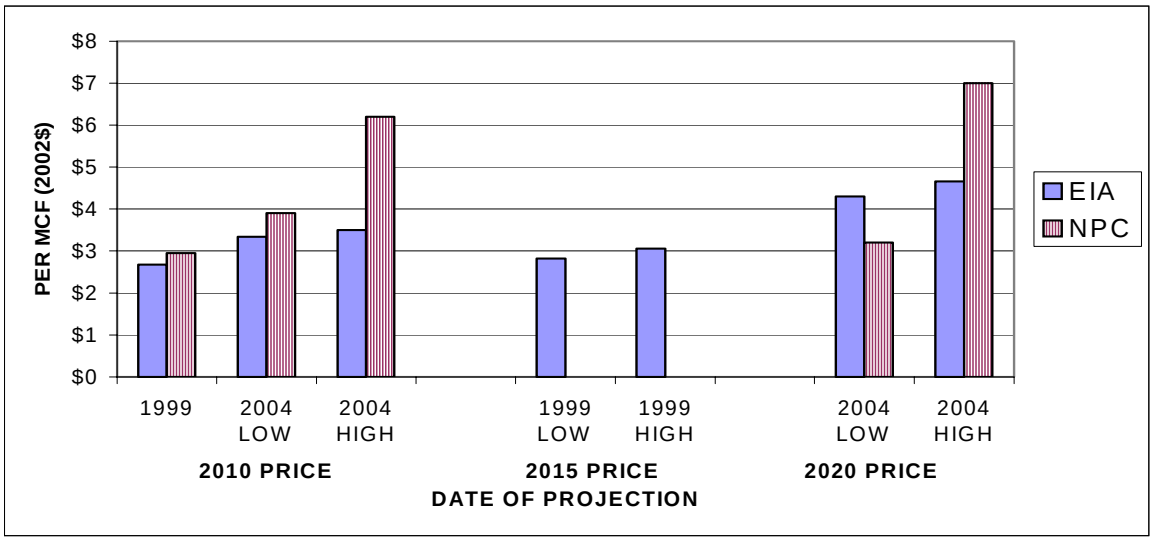
The National Petroleum Council (NPC) released a report in late 2003 that dramatically raised the estimated cost of finding and producing new natural gas supplies. This provided a perfect rationale for rising prices. The NPC is "a federally chartered and privately funded advisory committee," whose purpose "is solely to represent the views of the oil and natural gas industries in advising, informing, and making recommendations to the Secretary of Energy with respect to any matter relating to oil and natural gas, or to the oil and gas industries submitted to it or approved by the Secretary."[13] It is composed of integrated oil companies (18), large independent oil and gas producers (44), small independent oil and gas producers (83), natural gas companies (38), independent oil transporters, refiners and marketers (26), construction, drilling and oilfield support-service companies (41), financial and consultant support service companies (40), electric companies and other large consumers (8), and non-industry members (39).

In essence, the NPC asserts that the resource base threw the industry a curve. The NPC contends that the industry was surprised by the difficulty and cost of finding new gas. Caught off guard, there has been a surge in prices that will become permanent unless dramatic changes in policy are made. These changes would generally raise the profitability of the petroleum industry by lowering its costs of production. This was a dramatic shift from previous policy that criticized by others.

Exhibit II-4 shows that the 2003 NPC report represented a sharp shift in its estimate of the cost of finding natural gas by contrasting the 1999 estimates of future wellhead prices by the NPC and the Energy Information Administration to the later estimates by the same bodies. The 1999 projections came at a key moment. The increase in gas-fired electricity generation was becoming apparent and concerns were expressed about whether production could keep pace. The reports were also written just before prices began to rise sharply and become volatile.

Both the EIA and the NPC were quite optimistic in 1999. Projecting prices in the range of $2.80 to $3.80, the NPC concluded that "sufficient resources exist to meet growing demand well into the twenty-first century."[14] The EIA projected prices less than $3 in its *Annual Energy Outlook*, wherein the section headings shed extra light on the attitude – "Rising Gas Prices and Lower Drilling Costs Increase Well Completions, High Levels of Gas Reserve Additions Are Projected Through 2020, Significant New Finds Are Likely To Continue Increases in Gas Production."[15]

EXHIBIT II-4: THE DRAMATIC SHIFT IN PROJECTED WELLHEAD PRICES



Source: National Petroleum Council, *Natural Gas: Meeting the Challenges of the Nation's Growing Natural Gas Demand* (December 1999), p. 20, *Balancing Natural Gas Policy* (September 2003), p. 14; Energy Information Administration, *Annual Energy Outlook 2000* (December 1999), Table C-14, *Annual Energy Outlook* (January 2004), Table C-14.

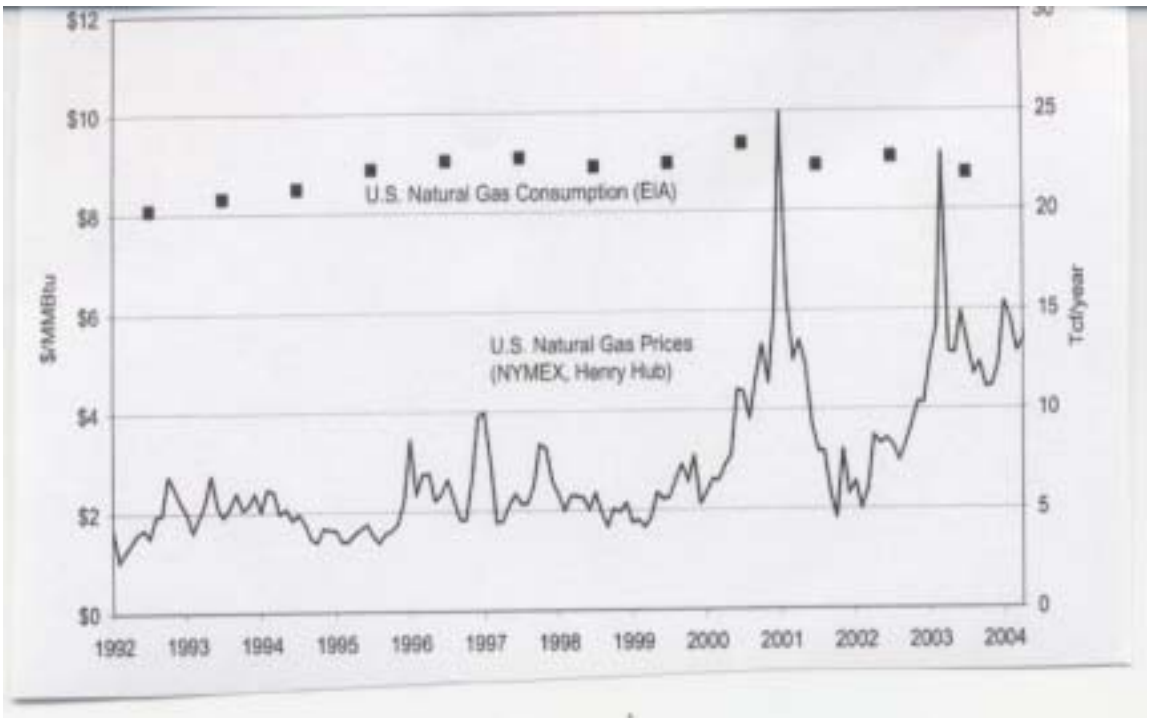
The tone in the 2003/2004 reports was considerably different. The EIA added a dollar to its projected prices and the NPC added over two dollars. The NPC declared that "North America is moving to a period in its history in which it will no longer be self-reliant in meeting its growing natural gas needs,"[16] while the EIA report opened with a cautious note:

> For almost 4 years, natural gas prices have remained at levels substantially higher than those of the 1990s. This has led to a reevaluation of expectations about future trends in natural gas markets, the economics of exploration and production, and the size of the natural gas resources. The *Annual Energy Outlook 2004* forecast reflects such revised expectations, projecting greater dependence on more costly alternative supplies of natural gas.[17]

3. Other Views of the Supply-Demand Balance

The NPC claims that "Current higher gas prices are the result of a fundamental shift in the supply and demand balance…. [that] will result in undesirable impacts to consumers and the economy, if not addressed."[18] Others correct the record, pointing out, as Exhibit II-5 shows, that,

EXHIBIT II-5: U.S. NATURAL GAS DEMAND AND PRICES

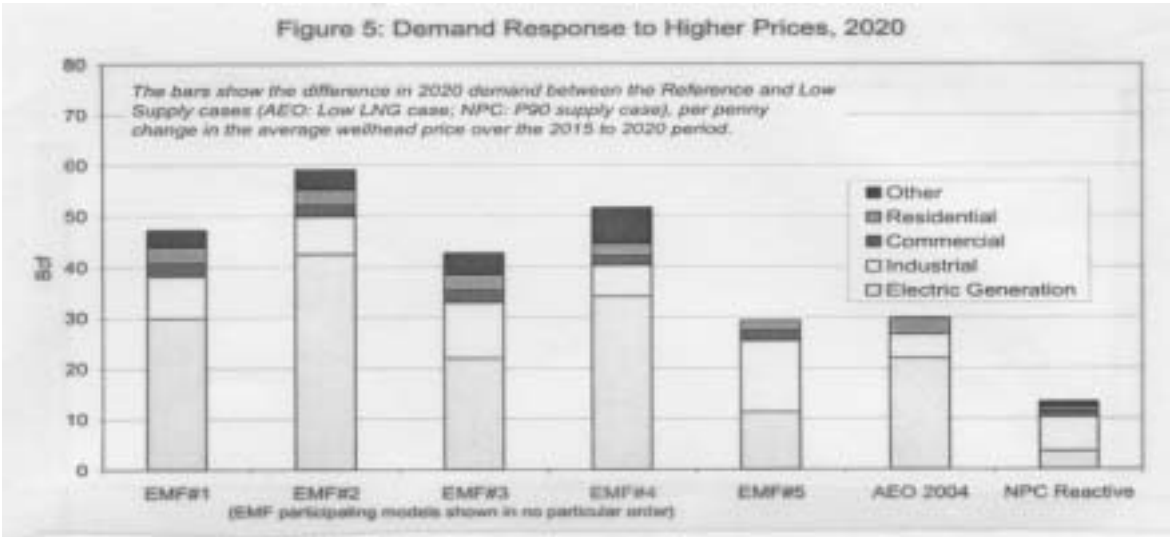


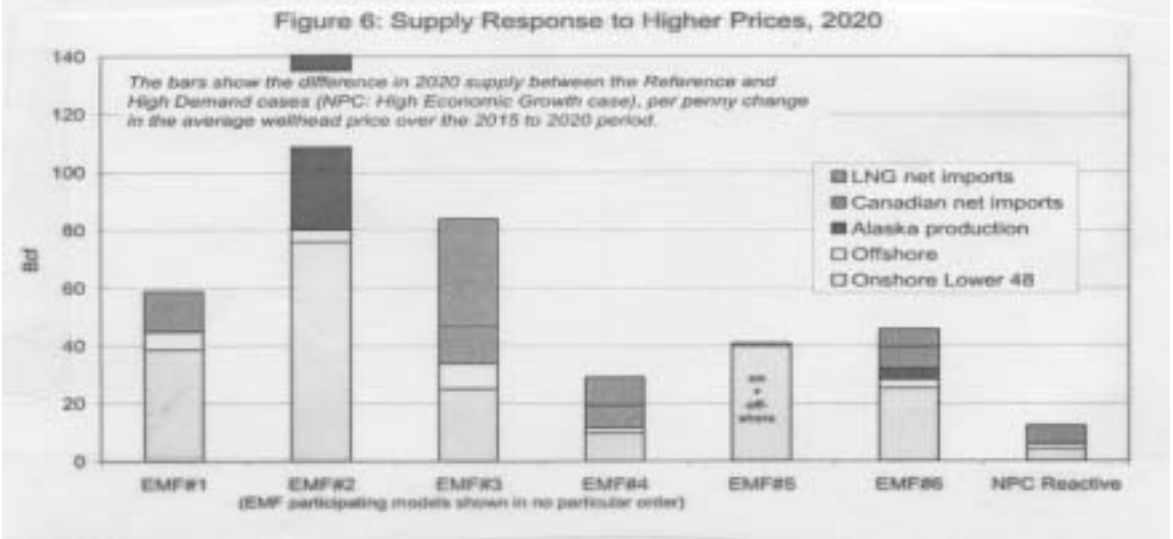
Source: Ken Costello, Hilliard G. Huntington and James F. Wilson, *After the Natural Gas Bubble: A critique of the Modeling and Policy Evaluation Contained in the National Petroleum council's 2003 Natural Gas Study,* July 8, 2004, Figure 1.

to be clear, however, the fundamental shift in the NPC outlooks has been in supply, not in demand…. In the 2003 NPC Report, the resource base assessment for the Lower-48 and Canada has been reduced by 20%… The NPC forecast of U.S. gas consumption… has been reduced by over 15% compared to the 1999 report, while prices are expected to be 40% to 70% higher than anticipated in the 1999 report."[19]

The NPC's shift from optimism to pessimism about the supply-demand balance rests on assumptions about the behavior of the natural gas market that are not consistent with historical experience. These assumptions are not shared by others (see Exhibit II-6). As we

EXHIBIT II-6: THE NATIONAL PETROLEUM COUNCIL NATURAL GAS STUDY DRAMATICALLY UNDERESTIMATES MARKET RESPONSES TO PRICE INCREASES





Source: Ken Costello, Hilliard G. Huntington and James F. Wilson, *After the Natural Gas Bubble: A critique of the Modeling and Policy Evaluation Contained in the National Petroleum council's 2003 Natural Gas Study,* July 8, 2004, Figures 5 and 6.

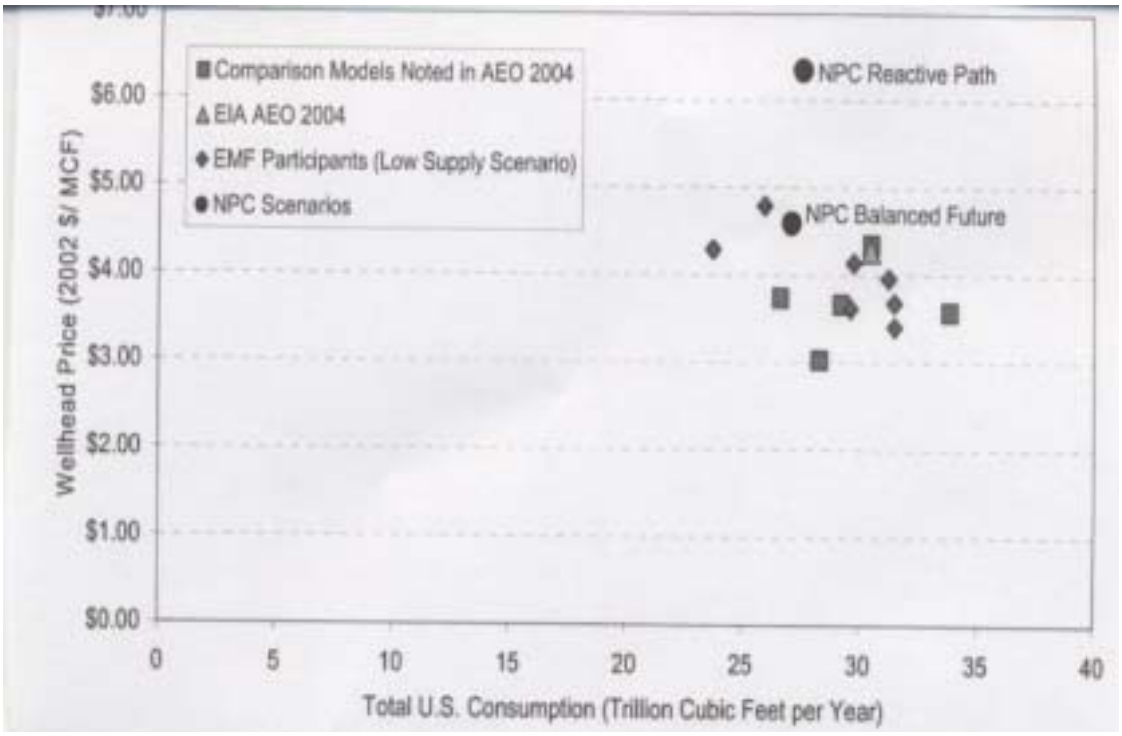
have seen, the data from the most recent years reinforces this observation. The NPC's pessimism is driven by extremely pessimistic assumptions about the supply and demand responses to price changes.

4. The Cost of Production

The fact that the NPC's price projections are fifty percent higher in their base case than most others should not obscure a more important observation. There was a consensus that prices over the next twenty years would be in the range of $4.50 (in 2002 dollars) per mcf. With today's wellhead prices running in the range of $7.50 to $10 per mcf, $4.50 may not sound like a big number, but it still represents more than a doubling of the price compared to the previous twenty years. Recently, the EIA has raised its estimate of the cost of natural gas production to $5.50.

Other analyses offer a different view. Some analysts project the underlying costs at much lower levels than the industry. Exhibit II-7 shows the sharp difference between the

EXHIBIT II-7: COMPARISON OF NATURAL GAS OUTLOOKS, 2020

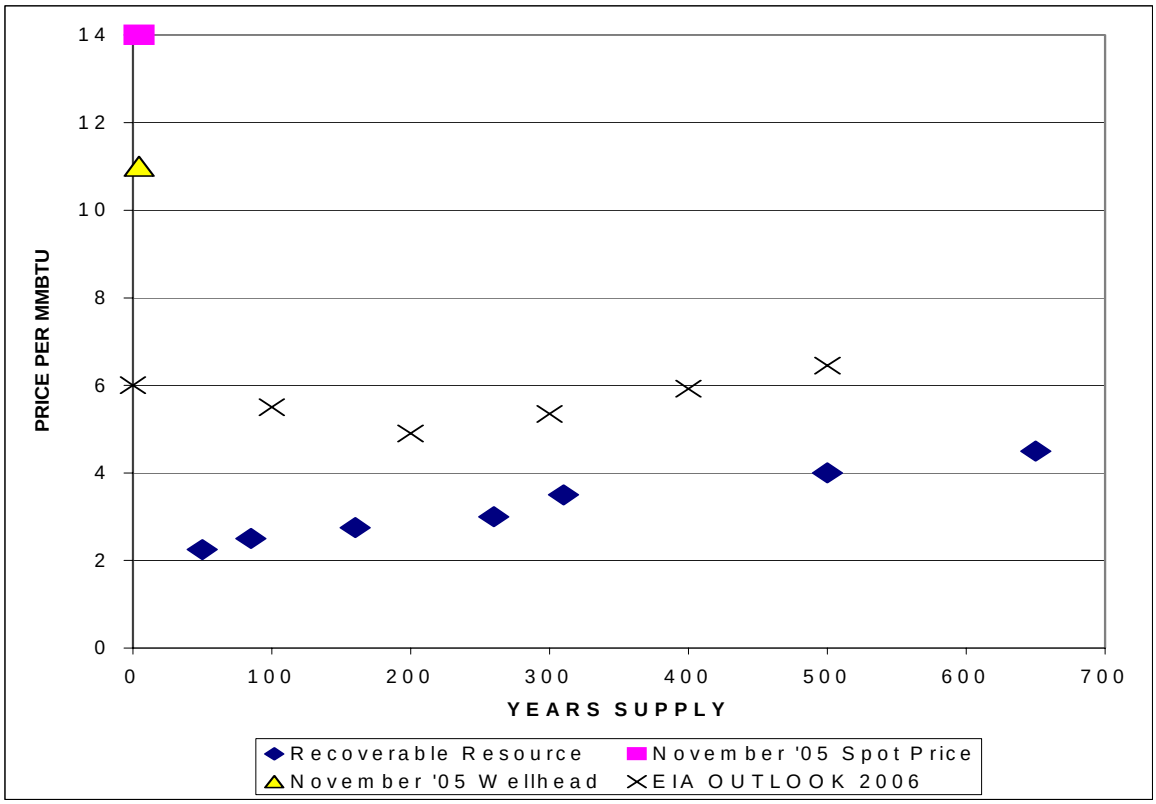


Source: Ken Costello, Hilliard G. Huntington and James F. Wilson, After the Natural Gas Bubble: A Critique of the Modeling and Policy Evaluation Contain in the National Petroleum Council's 2003 Natural Gas Study, July 8, 2004. Figure 3.

National Petroleum Council price projection and a number of other studies, including those by the Energy Information Administration.

Exhibit II-8 shows mid-point estimates for the full-cycle cost of gas recovery plotted as the number of years of resource recoverable at an annual consumption of 25 trillion cubic feet. Note that Exhibit II-8 is quite consistent with Exhibit II-7 in that it shows a resource cost in 2020 at production levels of 25 to 30 trillion cubic feet (TCF) of about $4.00 per mmBtu. Exhibit II-8 also presents the most recent EIA estimate of the cost of production across time, assuming that approximately 100 Tcf is produced in each five-year period. Thus, 2010 is plotted at the 100 Tcf point; 2015 is plotted at the 200 tcf point, etc.

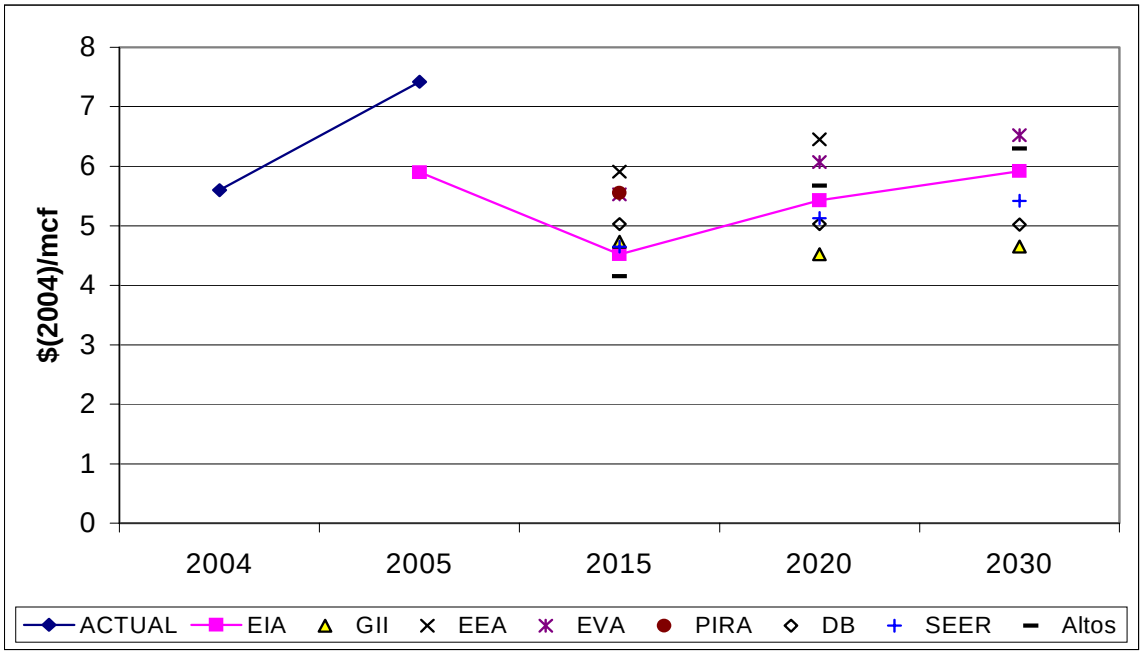
EXHIBIT II-8: DISLOCATION IN NATURAL GAS MARKETS



Sources: Energy Information Administration, *Annual Energy Outlook: 2006*, February 2006, James R. Choukas-Bradley and Michael F. Donnelly, *A Report on Projected Natural Gas Prices and Dynamics of the Natural Gas Marekts for 2005 and Beyond*, February 11, 2005, NyMex

Current prices are far in excess of the estimated resource costs of production. Exhibit II-9 compares the EIA estimates of costs to estimates prepared by other petroleum industry analysts. The numbers are presented in constant 2004 dollars. The gap in 2005 of $2.50 per mcf is equal to about $50 billion for the year. Prices for this year (known as six and twelve month strips) are above last year. Prices for the next couple of years are higher still. In other

EXHIBIT II-9: PROJECTED NATURAL GAS PRODUCTION COSTS



Source: Energy Information Administration, *Annual Energy Outlook 2006: With Projections to 2030*, February 2006, Table 23, EIA *Natural Gas Database* for actual 2005 prices. GII = Globabl Insight Inc.; EEA = Energy and Environmental Analysis, Inc.; EVA = Energy Ventures Analysis Inc.; PIRA = PIRA Energy Group; DB = Deutsche Bank, AG; SEER = Strategic Energy and Economic Research; Altos = Altos Partner North American Regional Gas Model.

words, there are hundreds of billions of dollars at stake in the current dislocation in the natural gas market.

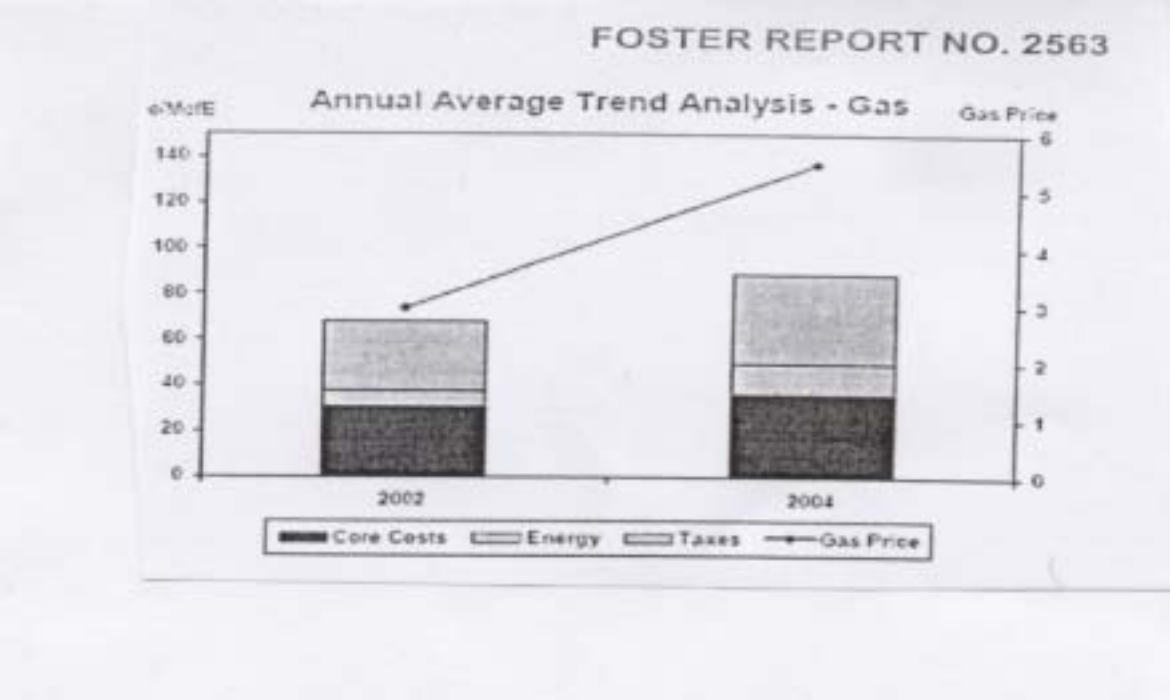
Other estimates of short run changes in the resource base and the cost of production also give a different perspective on the resource base and the cost of production. As noted earlier, the Potential Gas Committee estimates almost a three percent increase in proved reserves over the past two years and virtually no change in total supply, notwithstanding the fact that approximately 38 bcf had been produced in that period.[20]

Ziff Energy Group, which studies the economics of field operations, also observes increases in natural gas production from mature basins.

> The Permian Basin is considered to be the largest onshore U.S. oil-producing region, despite a steady decline in annual production since its peak in 1973. During the past 5 years, there has been a trend to increasing gas production, both from shallow horizons (e.g. Sonora area) and deeper reservoirs (e.g. Ellenberger).[21]

Ziff Energy's Study of increasing costs in these areas also shows that price increases at the wellhead have greatly exceeded cost increases (see Exhibit II-10).

EXHIBIT II-10: OPERATING COSTS AND PRICES



Source Foster Report, No. 2563, October 20, 2005.

> According to a new report issue by Ziff Energy Group, producer operating costs in the Permian basin have increased significantly… The 2004 average operating cost for gas fields increased 31% to nearly 90 cents/MCF. By contrast, leasing gas field operators achieved average costs of less than 60cents/ Mcf.[22]
>
> Ziff Energy Group's 12th annual study of oil and gas fields in Western Canada quantified a significant increase in operating costs. The largest increase in 2004 was for exploration and operation of natural gas prospects – the weighted average increased 12%, to over $0.80/Mcf [$0.82/Mcf]. Main drivers of the cost increase were the many services expenses due to high levels of field activity and higher energy costs.[23]

In contrast to the increase of operating costs of about 30 cents/mcf, the price increase enjoyed by producers was approximately $2.50.

The gap between near-term prices in the range of $7.00 to $10.00 per mmBtu and the underlying costs of production is striking. Those who predict a lower full cycle cost for gas naturally tend to predict that prices will fall sharply, under the assumption that the real economics must overcome a temporary decoupling of prices from costs. That begs the question, however, of how the disjuncture came about in the first place. Without a good explanation of how the disconnect came to be, the mechanisms by which the gap can be closed are uncertain and the promise that it will be closed is subject to question. This gap also raises doubts about the claim that access to low cost supplies in environmentally sensitive areas will lower prices. With prices so far above costs, it is easy to doubt that lowering the cost of production will make much difference, other than to increase the profits of the gas producers.

C. Supply as a Strategic Variable

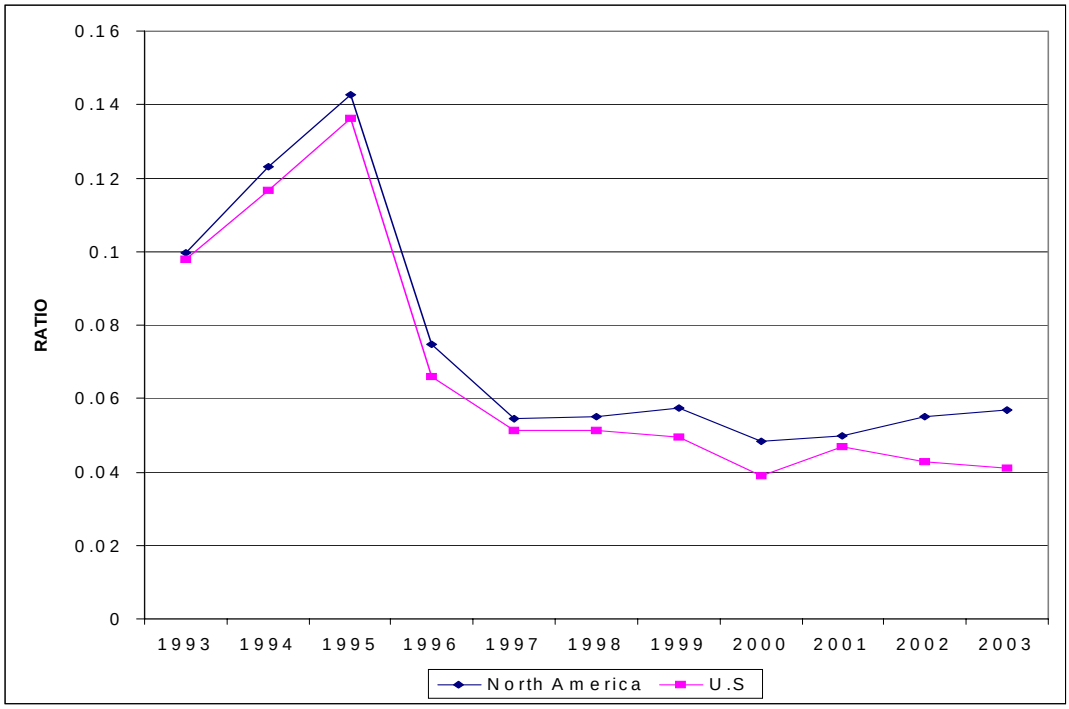
One explanation for the gap between costs and prices is that changes in industry structure, incentives, and behavior led to a slowdown in efforts to bring gas to market and a run-up in price. If this is correct and the incentives and structures do not change, then market performance will continue to disappoint.

The physical resource base in the U.S. is mature and experiencing increasing costs of discovery and development, but the physical changes are not large enough to account for the rising price. Demand is growing and has shifted slightly, which puts additional pressure on the resource base, but not enough to account for the tightness of supply or the increase in prices. One recent analysis attributed declining capacity to the interaction of the mature resource base and sluggish investment.

> "Effective production capacity is defined as the maximum production available from natural gas wells considering limitations of the production, gathering, and transportation systems," the report says. Although production increased to 52 Bcf/d in 2001, from 45 Bcf/d in 1985, effective production capacity has declined to 56 Bcf/d from 61 Bcf/d for that same period. ESAI [Energy Security Analysis Inc.] attributes the decline in capacity to a period of fewer increment well completions during the 1990s combined with the "treadmill effect" of maturing basins.[24]

Structural and behavioral changes on the supply-side of the market have contributed to the tightness of supply. When "The Majors' Shift to Natural Gas," as an EIA document put it, behavior in the industry changes. With the entry of major producers into the market, investment patterns changed and investment decisions now determined the state of the resource base (see Exhibit II-11). Investment decisions largely determined the state of the resource base. With majors shifting their focus in the late 1990s, production exceeded reserve additions, creating the condition for a tightening of the market. Investment shifted from exploration to development and extension. When prices began to rise, the response was slow. As Standard and Poor's noted in 2004:

EXHIBIT II-11: RATIO OF EXPLORATION TO DEVELOPMENT WELLS



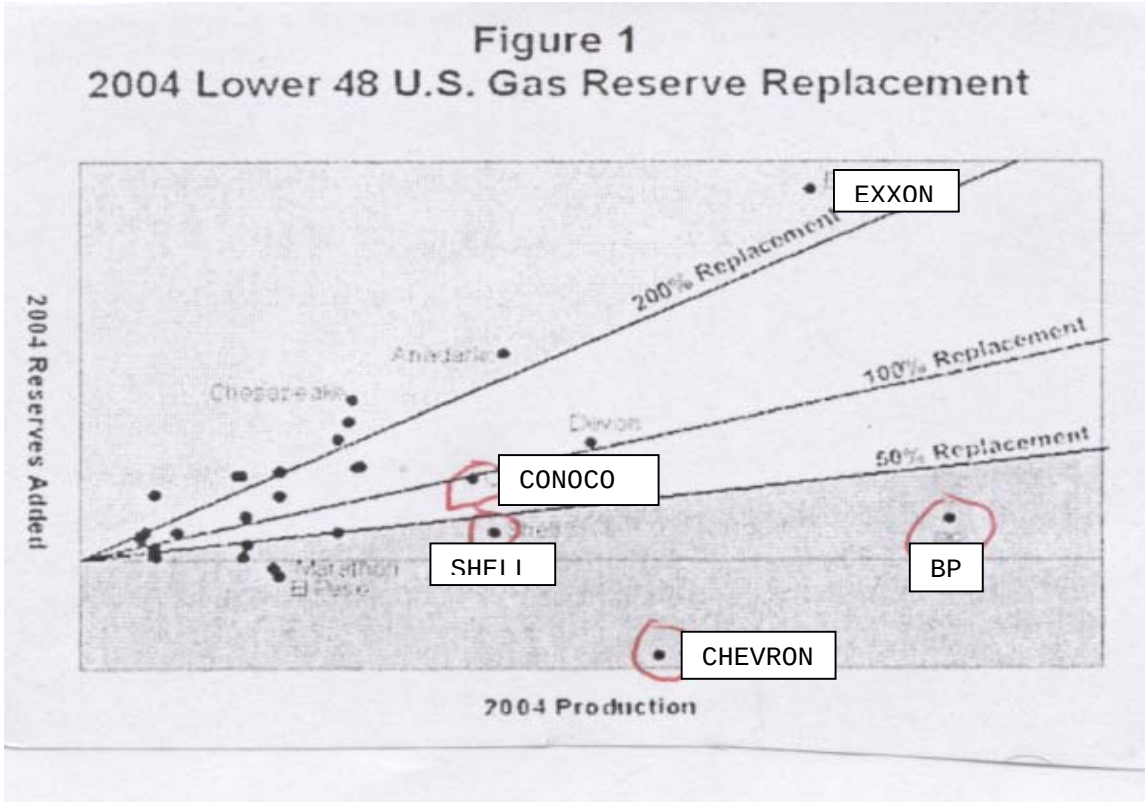
Source: Energy Information Administration, *Performance Profiles of Major Energy Producers*, various years

> It is unclear that producers are investing enough to grow production materially – and this follows a year [2003] in which the domestic gas production (including acquisitions) of integrated producers appears to have declined…
>
> [M]ajor integrated companies, which appear to be reinvesting only 30 to 40 percent of their domestic cash flow in the United States, have made strategic decisions to allow their shallow-water and onshore natural gas production to deplete to redeploy capital to international (mainly oil) projects.[25]

A recent *Wall Street Journal* story provides good context. Under close scrutiny, following gasoline price increases, reports of record third quarter profits, and consumer outcry facing dramatic increases in winter heating bills, the WSJ reported that "Big Oil Firms Join Hunt for Natural Gas in the U.S."[26] But why has it taken a decade and a tripling of price to get them into the hunt? Complaints about underinvestment in domestic U.S. natural gas resources have been mounting for years.

Exhibit II-12 shows that as recently as 2004, the majors were lagging in the effort to replace their reserves. The circled entities are the four remaining majors — BP-Arco-Amoco, Exxon-Mobil, Chevron-Getty-Texaco, ConocoPhilips. Listing the names reminds us of how

EXHIBIT II-12: THE MAJORS LAG IN RESERVE REPLACEMENT



Source: Foster Reports, 2544, June 9, 2005, p. 22

many firms disappeared in the merger wave of 1996-1002. Indeed, there is growing belief that "[p]roducing areas are active merger and acquisition targets"[27] because of the huge run-up in prices. The next wave of mergers may affect large and small firms alike.

> U.S. exploration-and-production companies flush with cash thanks to lofty commodity prices will likely step up their participation in mergers and acquisitions during the coming year, analyst Irene Haas said in a report Friday.
>
> "We believe M&A activity will intensify in 2006," said Haas, of Houston-based Sanders Morris Harris. "Most of the large integrated and larger majors are building up cash. After having gone through the exercise of debt reduction, share buybacks, and dividend increases, the companies are still looking at sizeable cash flow…

> "We believe that this cash build-up, and the lack of attractive new places to invest, will fuel more merger and acquisition activities."[28]

Looking at capital spending patterns for both exploration and acquisitions, the authors noted that "M&A spending did draw a greater share of the funds, nearly all at the expense of development outlays."[29] Having allowed the price to rise to extreme levels, it became highly profitable for large oil firms to suddenly rediscover the U.S. resource base.

> In the past few months, BP and Exxon have committed to long-term developments of U.S. fields they have held for years but haven't given much attention to….
>
> While tapping these new gas reserves probably will require costly technology, the high price of natural gas in the U.S. makes the investment attractive. In New York, natural gas has been trading well above $10 per million British thermal units since late August, more than quadruple its price at the beginning of the decade. Prices are expected to stay high for years.
>
> "The pricing outlook for North American natural gas is so favorable that these projects are very attractive." [30]

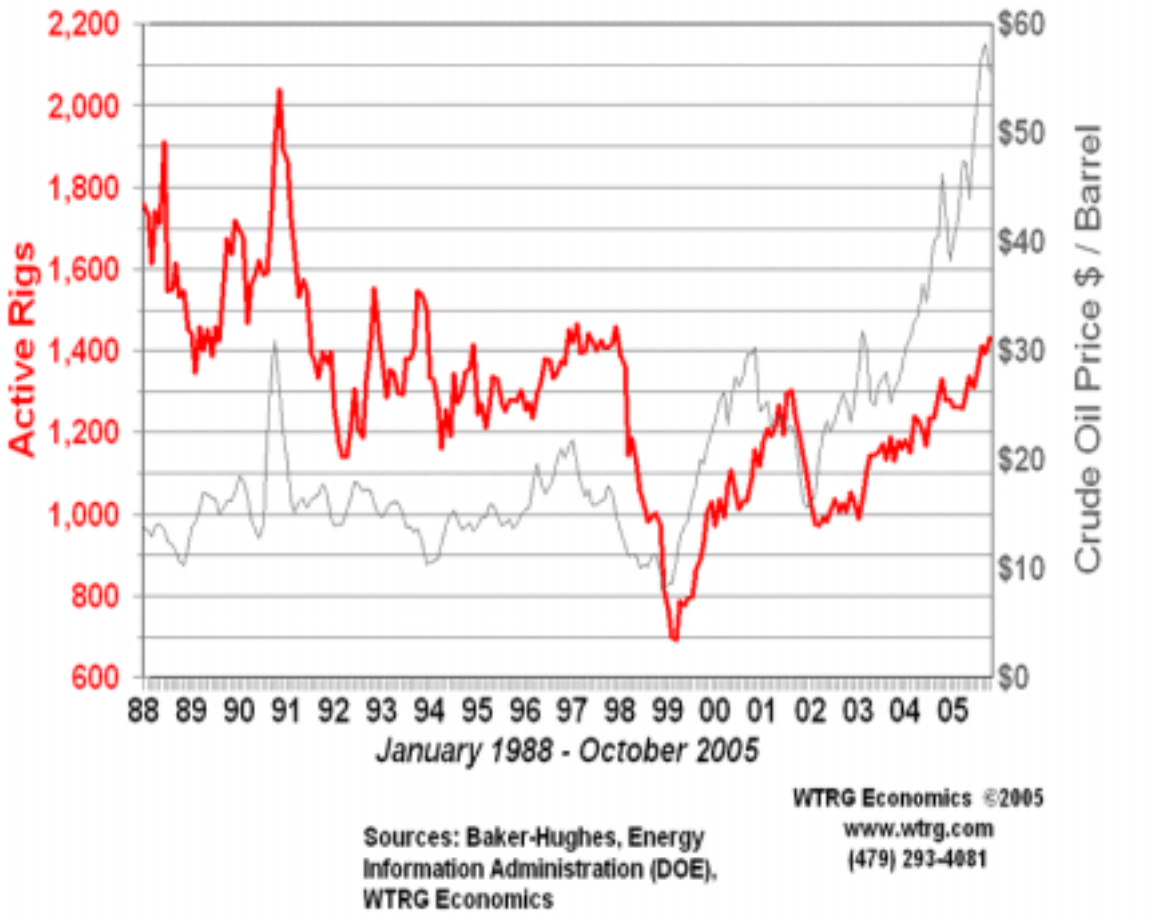
Drilling activity does respond to price increases, but it has been muted (see Exhibit II-13). Since 1999, which saw the lowest natural gas price in the past decade, there has been a doubling of the rig count, compared to a six-fold increase in the price of oil and a similar increase in the price of natural gas. Nevertheless, the rig count was higher in 1996-1999, when the oil price was less than half of what it is today. The implicit elasticity of supply of rigs with respect to price is considerably less than one. Rigs drilling for natural gas show both a faster rate of growth, but also a larger price increase.[31]

The long period of low levels of drilling, followed by the rapid expansion, contributes to the inefficient and sluggish response. Capacity is destroyed during the down cycle and then the rush to increase capacity increases the cost.

> "When price returns get high enough people expand capacity. The returns are the highest we've seen for land rigs in a few decades…" Manufacturers building new rigs can expect a return of 25% to 30%.[32]
>
> Drilling rig day rates have doubled since 2000 and new rigs are available only if a producer is willing to guarantee long-term leasing at these higher rates.[33]

The massive run up in prices of recent years has resulted in a huge throw off of cash, which is not being put back into the industry. As an analysis in the *New York Times* under the headline "High Profits, Sluggish Investments,"[34] pointed out after the announcement of yet more record profits, "The real issue, though, is not how much the oil companies are making, but what they are doing with the money. In too many cases, they seem to have only a limited

EXHIBIT II-13: U.S. WORKING RIG COUNT

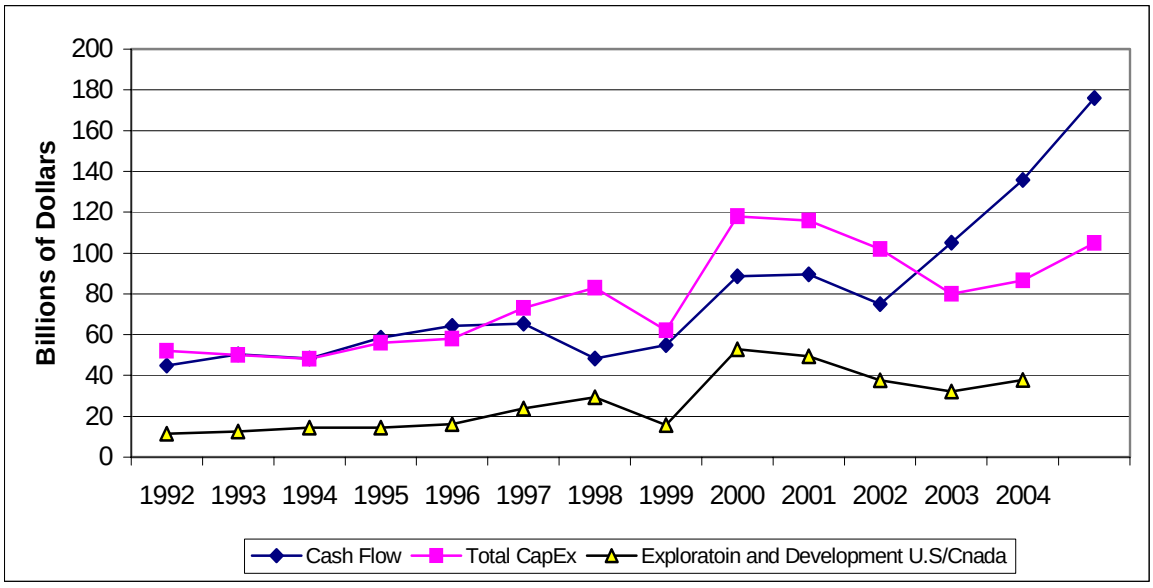


interest in investing it in projects that might help prevent or ameliorate a new energy crisis."[35] The article points out that Exxon essentially decides what to invest based on its projections of prices and "Exxon's price forecasts have not risen much in recent years, even though market prices have soared."[36] The dramatic shift in behavior among the majors is also unprecedented. "I checked back to 1976, and found that until 1997, Exxon always invested more than it made. Now it invests less than half of its profits."[37]

Exxon's ability to choose its target price, and not fear that it will lose out to others, who act more aggressively, is one indication of its market power. The fact that Exxon invested more than it earned until the onset of industry consolidation in the mid-1990s underscores the fact that companies generally use two major sources of cash to invest in an industry. Depreciation – the return of capital – is a major source.

The picture is even more distressing when one looks at cash flow – which is made up almost entirely of the return of and on capital. When an investment is depreciated, the capital is returned to the investor. This return of capital is a major source of cash flow. Return on capital is the income that companies earn. As Exhibit II-14 shows, the majors simply cannot

EXHIBIT II-14: CASH FLOW AND CAPITAL EXPENDITURES



Source: EIA, *Performance Profiles of Major Energy Producers,* various issues; 2005 estimated based on year-over-year changes for Exxon-Mobil, Shell, and Chevron reported in initial annual reports for 2005.

absorb the flood of cash. The increase in expenditures on exploration and development in the U.S. and Canada, which will do the most for natural gas markets in the U.S., is dwarfed by the increase in cash flow, as are total capital expenditures.

> Meanwhile, ESAI noted that more cash for exploration and development (E&D) activities has been invested abroad than domestically. This trend is more evident in oil spending, but natural gas spending may follow suit if global (LNG). This partially explains the declining reserve replacement ratio for natural gas, says ESAI.[38]
>
> We do not see the level of increased domestic production activity from the international majors and certain large North American independents that we would expect to see in a rational, competitive marketplace at current gas prices, which have been at a sustained average annual price of greater than $5.00 per MMBtu since mid-2002. Are these producers not investing in North American production at the levels that would be expected in a competitive marketplace, one that provides appropriate price signals related to supply/demand fundamentals? Rather than investing for incremental production that will produce supplies with the lowest possible incremental cost to meet domestic demands, are these producers investing in overseas projects, because their investment capital can yield a greater and faster return… [T]he multinationals

appear to be taking the "windfall" profits from high domestic gas prices to invest in overseas projects largely owned by foreign national oil companies that they believe offer better investment opportunities, perhaps with net cash-flow payout in two-three years… The flight overseas by dollars realized from domestic gas prices realized since 2000…effectively means that the American consuming public is financing international projects. Such activity, in turn, helps to support the continued high level of domestic gas prices by resulting in a reduced level of domestic production with an increased per-unit cost than would otherwise be indicated by the level of domestic prices.[39]

D. Short Run Factors

The impact of the hurricanes on Gulf Coast production has been the focal point of the price increase story in the short-term. Interestingly, projections of a severe hurricane season were reported to have driven the price up prior to the occurrence of the actual hurricanes. Year-over-year prices were up over one-third even before the hurricanes arrived.

At its height, the loss of production was about 10 percent of national capacity, although it has been noted that at the height of the production loss there was also a great deal of demand destruction on the Gulf Coast. Thus, the loss of gas available to the market was considerably smaller than the loss of output in the Gulf. Some estimates put this figure as high as a third of the total loss of production. These underlying fundamentals were evident throughout.

September 9, 2005 – Even though 8% to 16% of daily gas supplies have disappeared in Hurricane Katrina's wake, markets across the country have managed to stay whole largely because of a significant drop in demand, particularly in the Gulf Coast region, industry officials said Tuesday.

Merrill Lynch's top exploration-and-production analyst thinks much of the natural gas supply shortages caused by Hurricane Katrina will be offset by losses of industrial and commercial demand caused by the same storm.

"There is no doubt that the Street will fixate on just supplies, but one needs to consider the demand effects.'[40]

October 10, 2005 – While data in the two weeks after Katrina made landfall Aug. 29 "suggested that enough demand had disappeared due to the storm that we are roughly in supply/demand balance, the additional damage creates the fear that demand will recover more quickly than our supply will come back," Elder said.[41]

November 18, 2005 – "I think the surprising thing continues to be that the demand destruction going on has more than offset any missing Gulf gas," said Smith, President of Natchez, Miss.-based Stephen Smith Energy Associates.

> And even though prices have come off their peaks in most regions, it may take weeks for that to translate into restored industrial consumption.[42]
>
> **November 30, 2005** – [E]ven with hurricane-related shut-ins exceeding 450Bcf [billion cubic feet] from offshore Gulf of Mexico facilities and probably another 100 Bcf from onshore Gulf coast facilities, storage levels as of mid-Novembers are almost 3.3 Tcf [Trillion cubic feet]. The notion that storage could be near 3.3 Tcf in mid-November despite 550 Bcf of shut-in production is mind-boggling. Since the weather during September through mid-November was fairly mild, a small amount of this unexpectedly high storage level could be attributed to reduced weather-sensitive loads. The vast majority, however, must relate either to physical limitations on loads because of hurricane damage (e.g., refineries under water) or price sensitive demand destruction in otherwise available facilities (e.g., shut-in ammonia)… These weather related reductions are now greater than the continuing estimated shut in production.[43]
>
> **January 23, 2005** – Many experts had estimated that as much as 3 bcf/day of Outer Continental Shelf production would be off-line. According to the Minerals and Management Service, that figure is closer to 1.8 bcf/day as volumes have been restored more quickly than many observers had thought.[44]

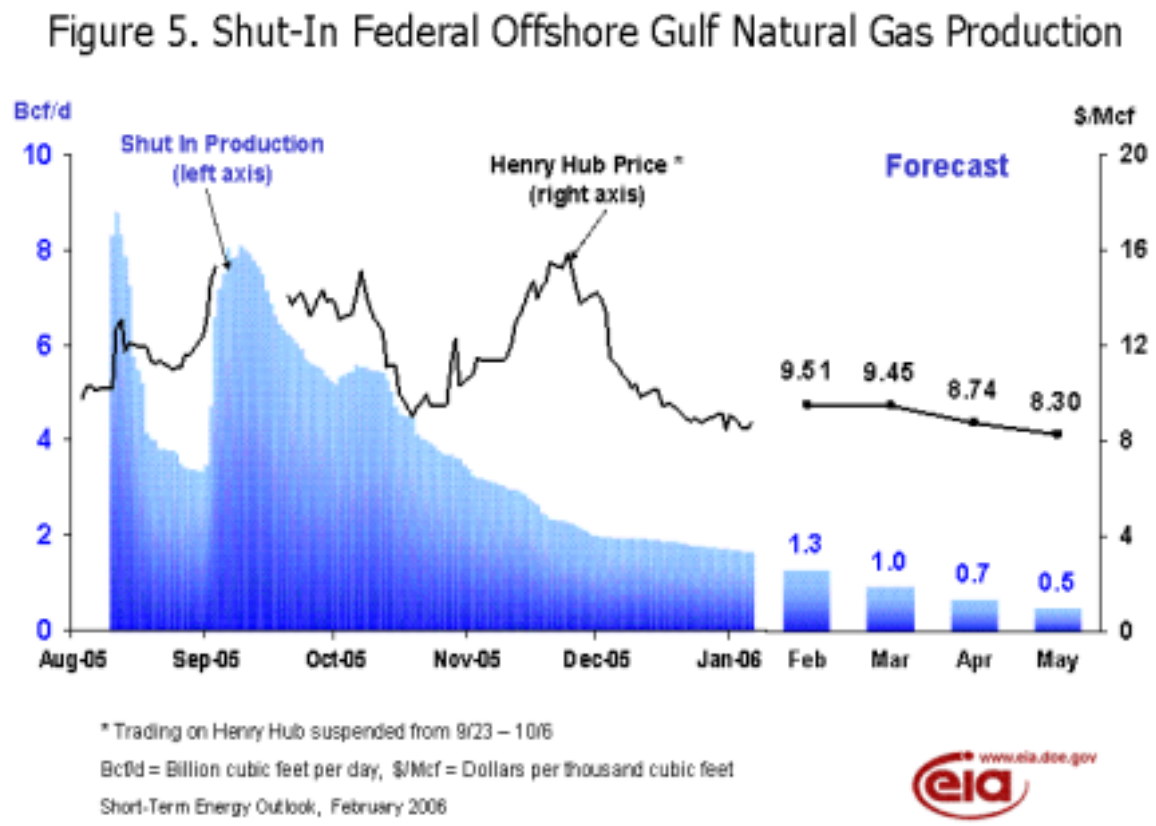
Notwithstanding the run up in prices before the hurricanes, by December the spot price had almost doubled again. Shut-in production had been reduced by over half, so the shortfall to the national market was down to three percent. Storage was well above average. With what is likely to go down as one of, if not the, warmest Januaries on record, market fundamentals had shifted in a positive direction. Notwithstanding the effects of recent hurricanes, supply and demand were less tight than before the hurricanes – demand down more than supply. Gas in storage was up over 50 percent, at what is likely to be a historic high (see Exhibit II-15).

This would suggest that prices should be similar, or even a little lower than they have been in previous years. That is not the case (see Exhibit II-16). They are running about $3.00 higher, up over 60 percent at the wellhead and in the spot market. Futures prices are even higher still, running about 40 percent above current prices and about twice as high as the estimated long run costs of production.

There was also a shift in the domestic price relationship between oil and gas. Throughout the 1990s, the ratio of the price of oil per barrel at the wellhead (West Texas Intermediate) to a thousand cubic feet of natural gas at the wellhead was about 9:1 or 10:1. In recent years, the price of natural gas has increased relative to that of crude. The ratio of wellhead crude to wellhead natural gas has declined, though, to about 6:1 or 7:1.

The correlation between oil and gas prices is a convenient explanation for the shift up in prices and some argue that "oil prices appear to be holding them [natural gas prices] up."[45] Some question whether the correlation actually represents causation. The ability to actually

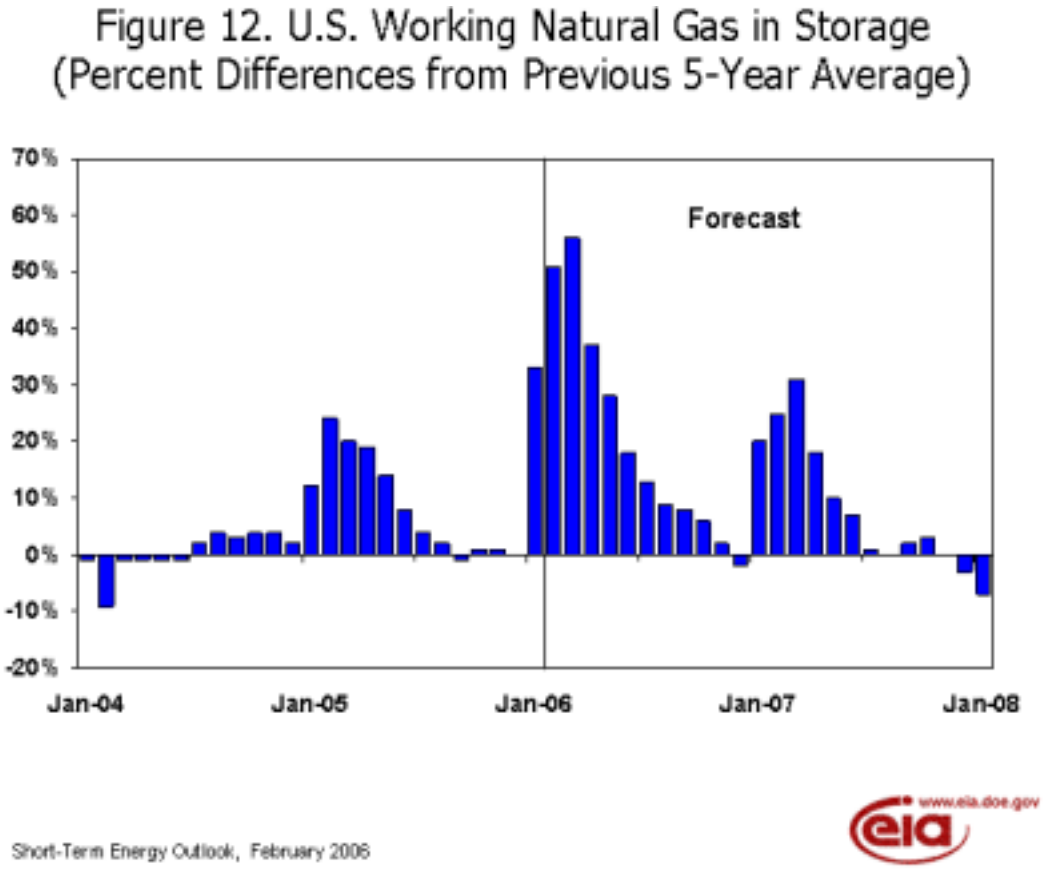
EXHIBIT II-15: HURRICANES AND PRICES



switch fuels has been declining. Therefore the cross-price elasticity of demand, which has been historically low, has been declining.

> Following up on price effects of the current tight gas market, *Stephen Brown*, from the Federal Reserve Bank of Dallas, as Director of Energy Economics and Microeconomic Policy Analysis, conceded an overall steady gain in energy prices since early 2002, a period in which natural gas spikes closely follow the track of oil prices… The 10-1 Rule ($20 to $2, oil-to-gas price) that was notable prior to the new century, according to Brown, has been supplanted in the past five years by a 6-1 Rule (oil-to-gas price ratio) in a general sense. However, a purportedly more sophisticated model of prices in the marketplace – the Aburnertip parity rule" – would appear to work better as a tracker, accounting for about 70% of the variation in natural gas prices during 1994-2005.
>
> The problem with these models, explained Brown, is the lack of any accounting for the seasonality of gas demand and contemporaneous price shifts

EXHIBIT II-16: DRAMATIC INCREASE IN STORAGE



of the fact that fuel-switching capabilities of utilities seem to have rapidly diminished in recent years.[46]

Only about 1.25 Bcf/d of U.S. natural gas demand can be shed in the short term through two kinds of market adjustment – immediate fuel switching and lower consumption of gas as a feedstock. This is the gist of a recent report by Canadian Energy Research Institution (CERI)…

The ability to switch to residual oil (resid) has declined over time due to capital requirements and emissions limits. In many instances the equipment has deteriorated from lack of use and has to be replaced…

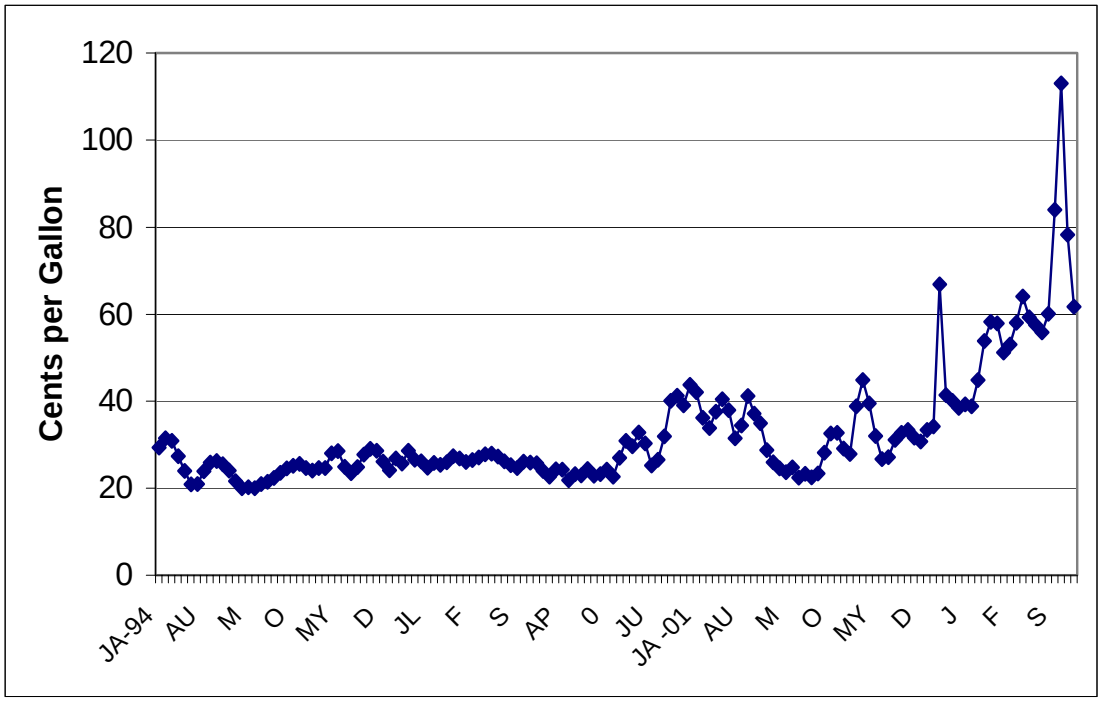
Fuel switching from gas to either resid or to distillate creates a short-term reduction of about 0.5 Bcf/d, perhaps tripling over time to 1.5 Bcf/d.[47]

The question about whether this is a mere correlation or a causal relationship is underscored by the complaints we have noted that U.S. gas prices were five or ten times above

the prices in other developed nations. Many of those nations pay the same prices for oil but the linkage between oil and gas is not evident. Because the correlation does not represent the actual ability to switch fuels on the demand side, if there is a causal relationship, it may lie on the supply side. In markets dominated by majors producers, who straddle the two fuels, and large traders who play in both commodities, the majors link the prices and holding out for prices that they think reflect the relative value of the fuels.

If we take this view, then we run into a painful irony from the consumer point of view. "Burner-tip parity," or at least the ability to expand the range over which natural gas prices will vary, is influenced by the ability of refiners to increase their margins (see Exhibit II-17). The increase in domestic spread on distillate (diesel) would translate into a substantial price increase for gas, as much as $1.60 per mcf.

EXHIBIT II-17: DOMESTIC SPREAD ON DIESEL
(Retail Minus Crude and Taxes)



Source: Energy Information Administration, Database.

Based on these fundamentals, it does not seem that a 75 percent increase in the wellhead price or a doubling of spot prices as shown in Exhibit I-2 should have taken place. In financial commodity markets, however, perception ("fear and frustration"[48]) may be more influential than facts on the ground. Thus, physical market fundamentals in the short term and long term do not seem to be an adequate explanation for the pricing behavior of recent years. Choukas-Bradley and Douglas summarized this situation as follows.

These extraordinarily high prices for natural gas have occurred during a time of supply and demand balance, a balance that has been the operative characteristic of industry fundamentals for some time. Indeed, from 2003 to 2004, prices increased dramatically despite improved market fundamentals, increasing production, higher rig counts, a robust storage position, relatively mild weather, and tempered demand. Nonetheless, we have been and remain in the midst of a climate of crisis concerning natural gas prices, with market prices subject to wild swings resulting from trading decisions by both commercial and speculative traders that respond to "psychology" and "spin," either in spite of or in the absence of reliable, real-time fundamental information. Trading of the natural gas contract on the NYMEX continues to be dominated by technical trading, with the result that in a period of stability in market fundamentals, the market will tend to see prices remain at high levels if they start at high levels, just as they would remain at moderate levels if they started at moderate levels. That is, part of what is propping up current prices is . . . current prices.[49]

ENDNOTES

[1] Pirrong, Stephen Craig, *The Economics, Law and Public Policy of Market Power Manipulation* (Boston: Kluwer, 1996), p. 10.
[2] See Bohi, Douglas R. *Analyzing Demand Behavior: A Study of Energy Elasticities* (Baltimore: Johns Hopkins University Press, 1981); Waverman, Leonard, "Econometric Modeling of Energy Demand: When Are Substitutes Good Substitutes?," in David Hawdon, *Energy Demand: Evidence and Expectations* (London: Surrey University Press, 1992), p. 16. Urga, Giovanni and Chris Walters, "Dynamic Translog and Linear Logit Models: A Factor Demand Analysis of Interfuel Substitution in US. Industrial Energy Demand," *Energy Economics*, 25, 2003, p. 18, concludes that "estimates of long run cross elasticities are well below the threshold of unity."
[3] Consodine, Timothy J. and Eunnyeong Heo, "Price and Inventory Dynamics in Petroleum Product Markets," *Energy Economics*, 22, 2000, p. 527, conclude "supply curves for the industry are inelastic and upward sloping." See also "Separability, Functional Form and Regulatory Policy in Models of Interfuel Substitution," *Energy Economics*, 1989.
[4] Pirrong, Stephen Craig, *The Economics, Law and Public Policy of Market Power Manipulation* (Boston: Kluwer, 1996), pp. 10… 24… 59. See also, Williams, Jeffrey and Brian Wright, *Storage and Commodity Markets* (Cambridge: Cambridge University Press, 1991); Deaton, Angus and Guy Laroque, "On the Behavior of Commodity Prices," *Review of Economics and Statistics*, 1992.
[5] Pirrong, pp. 10… 24… 59. See also, Williams, Jeffrey and Brian Wright, *Storage and Commodity Markets* (Cambridge: Cambridge University Press, 1991); Deaton, Angus and Guy Laroque, "On the Behavior of Commodity Prices," *Review of Economics and Statistics*, 1992.
[6] Ewing, Bradley T., Farooq Malik and Ozan Ozfidan, "Volatility Transmission in the Oil and Natural Gas Markets," *Energy Economics*, 24, 2002 p. 536.
[7] Ewing, Bradley T., Farooq Malik and Ozan Ozfidan, "Volatility Transmission in the Oil and Natural Gas Markets," *Energy Economics*, 24, 2002 p. 536.
[8] Pillipovic, Dragana, *Energy Risk: Valuing and Managing Energy Derivates* (New York: McGraw-Hill, 1998), p. 3.
[9] Matthew Seryneck, "Investors Beware," p. 37.
[10] Pirrong, Stephen Craig, *The Economics, Law and Public Policy of Market Power Manipulation* (Boston: Kluwer, 1996), pp. 10… 24… 59. See also, William Jeffrey and Brian Wright, *Storage and Commodity Markets* (1991); Deaton, Angus and Guy Laroque, "On the Behavior of Commodity Prices," *Review of Economics and Statistics*, 1992.
[11] The California Energy Commission, *2005 Integrated Energy Policy Report*, November 2005, p. 133, citing comments of Rich Ferguson, Center for Energy Efficiency and Renewable Technologies, Transcript of the October 7, 2005, Energy Report Hearing on Natural Gas Prices Issues, notes that "that natural gas prices reflect large scarcity rents above the marginal costs of production that consumers are paying." An economic rent is "a payment in excess of what is necessary to keep it at its present occupation. (Pierce, David, W., *The Dictionary of Modern Economics* (Cambridge, MIT Press, 1984). P. 124.
[12] Foster Report, No. 2558, p. 13.
[13] From National Petroleum Council web site.
[14] National Petroleum Council, *Natural Gas: Meeting the Challenges of the Nationa's Growing Natural Gas Demand*, 1999, p. 36.
[15] Energy Information Administration, *Annual Energy Outlook* 1999 (Washington, D.C.: U.S. Department of Energy, 1999), pp. 74-75.
[16] NPC, 2003, p. 5.
[17] Energy Information Administration, *Annual Energy Outlook* (Washington, D.C.: 2003), p. 2.
[18] NPC 2003, p. 7.
[19] Costello, et al., p. 22.
[20] Foster Report, No. 2558.
[21] Foster Report, No 2562, October 20, 2005, p. 37.

[22] Id.
[23] Id., p. 31.
[24] Foster Report, No. 2546, June 23, 2005, p. 32.
[25] Beattie, Jeff, "U.S. Oil and Gas Producers Investing in Mergers, Not More Drilling – S&P," *Energy Daily,* April 26, 2004.
[26] Russell Gold, "Big Oil Firms Join Hunt for Natural Gas in U.S.," *The Wall Street Journal,* November 29, 2005, A1.
[27] Foster Report No 2576, January 27, 2006, p. 17.
[28] Platts, *Gas Daily,* Jan 17, 2006, pp. 1Y 6.
[29] Platts, *Gas Daily* September 27, 2005, p. 4.
[30] Gold, "Big Oil," p. A15.
[31] Foster Report, No. 2538, p. 2.
[32] Platts, *Gas Daily,* February 7, 2006, p. 6.
[33] Foster Report 2563, October 20, 2005, p. 20.
[34] Norris, Floyd, "High Profits, Sluggish Investment," *New York Times,* February 3, 2006, p. C-1.
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[40] Platts, *Gas Daily,* Sept. 9 2005, p. 6.
[41] Platts, *Gas Daily,* October 10, 2005, p. 6.
[42] Platts, *Gas Daily,* November 18, 2005, p. 3.
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[46] Foster Report No. 2576, January 27, 2005, p. 14.
[47] Foster Report, No. 2536, pp. 25.. 26.
[48] Barrionuevo, "Energy Trading," p. 3-3.
[49] Choukas-Bradley, James and Michael F. Donnelly, *A Report on Projected Natural Gas Prices and Dynamics of the Natural Gas Market for 2005 and Beyond,* February 11, 2005, pp. 1-2.

III. THE SHORT, TROUBLED HISTORY OF NATURAL GAS TRADING

Physical markets provide the context for financial markets; they do not explain the behavior of those markets. Factors that make markets vulnerable to a narrow range of strictly manipulative behaviors, like corners and squeezes, also make them vulnerable to a broader range of suspicious activities identified in the literature as abusive – front running, wash trading, rumor mongering, etc. Also, they make markets prone to volatility and, under some conditions subject to upward pressures on prices. The characteristics of energy markets make it easy for traders to exploit physical problems. Under these circumstances, the lack of transparency and oversight in the natural gas commodity markets is an open invitation to behavior that makes matters worse.

Given the vulnerability of the market, it is not surprising to see a price spiral. The history of trading in energy commodities, especially natural gas, has been wild and painful, to say the least. The behavior of this market gives rise to a pervasive suspicion, which is well justified. What has been documented has been limited to written complaints settled at the Commodities Futures Trading Commission (CFTC) or in federal court cases. While regulators and law enforcement scramble to catch up, consumers pay the inflated price. Catching abuse after the fact is not enough. Energy commodity markets need more transparency and more oversight so that problems can be prevented.

A. Act One: Planting The Seeds of Dysfunction

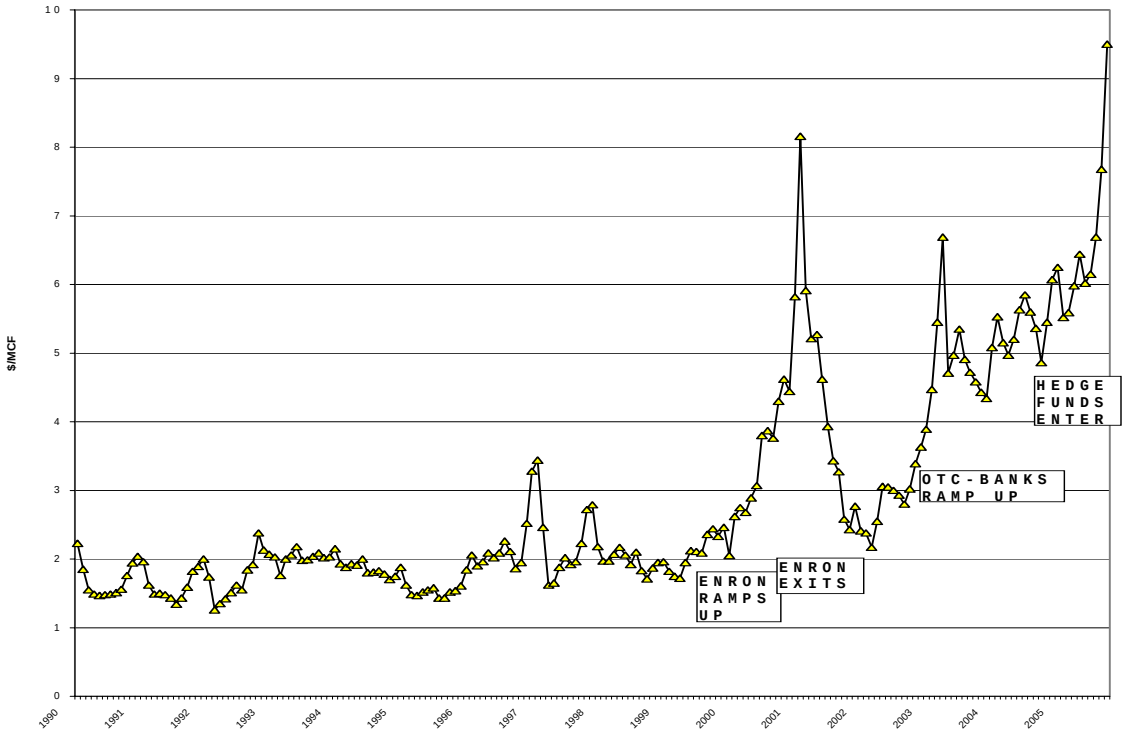
1. Trading Spins Out of Control

The setting of wholesale natural gas prices through trading in commodity markets is a recent phenomenon. The first natural gas market center, known as the Henry Hub, was set up in 1988, soon after deregulation of "old gas" in 1985. Hubs are locations where natural gas pipelines meet and the services necessary to physically exchange natural gas are located for traders who want to take delivery. The wellhead price of natural gas was not fully decontrolled until 1989. Early in 1990, the first natural gas futures were traded on the New York Mercantile Exchange (NYMEX).

A close look at the timing of the changes in trading activities and the movement of prices shows a coincidence that is just too striking to ignore. Exhibit III-1 overlays key points in the short history of natural gas commodity markets on the price history.

Natural gas prices were stable throughout the 1990s. While there were a couple of spikes in spot markets in the 1990s, spot and futures prices generally tracked the wellhead price closely in a narrow range of $2 - $3 per thousand cubic feet (mcf). After a slow start, these markets were said to be efficient in a technical sense.[1]

EXHIBIT III-1: WELLHEAD PRICES AND CHANGES IN TRADING ACTIVITY



Source: Energy Information Administration, *Natural Gas Database*.

This pattern came to a dramatic end in the spring of 2000. In the spring of 2000, natural gas prices at the wellhead began a sustained period above $3 that lasted for 16 months. The average price of natural gas in 2000-2001 was about twice the price of the previous decade. Spot market prices peaked at four times the average of the previous decade. Coincidentally, this was the period in which, it later came to light, a number of companies were manipulating or attempting to manipulate the market. This was the period during which the Enron-style merchant traders engaged in abusive practices.

Electricity deregulation emerged in the mid-1990s while the Federal Energy Regulatory Commission pressed deregulation and unbundling of natural gas pipeline markets, particularly in California. The California electricity crisis, which was interrelated with natural gas prices, had put pressure on these commodity markets.

Simultaneously, Enron launched its Enron Online trading platform in November 1999. It had moderate levels of trading (about $50 billion) through the first half of 2000. Subsequently, Enron's total trading exploded. In the first half of 2001, it did over ten times as much (half a trillion dollars).[2] Prices skyrocketed as well. Volumes escalated sharply and Enron played a key role. As a recent *New York Times* article noted, "Some traders have said that Enron Online was dominant enough to enable Enron to set market prices."[3]

While the Western electricity markets attracted the most headlines and revealed the most blatant abuses in terms of withholding of physical supplies and bogus trades, natural gas

markets were not immune. Enron played a large role in these markets and when it collapsed, so too did much private trading.[4] A court ruling allowing a lawsuit against Enron for abuse of commodity markets can be used to make the point: "Enron was positioned to yank prices up because its Enron Online [EOL] trading platform controlled fully 40 percent of average daily trading on the Henry Hub natural gas spot market. Further, other traders in that market "routinely looked to EOL and Enron for current [Henry Hub] spot market pricing information," according to the CFTC complaint.[5] The Henry Hub is the most important price setting spot market in the nation. This market share of activity by a single entity would virtually ensure that the hub was highly concentrated at that time.

By late-2001, signs of trouble at Enron were evident and trading began to dry up. In December 2001, bankruptcy shut down the platform. Trading did not recover for a period. Prices declined and remained stable.

> In February 2002, shortly after Enron declared bankruptcy, UBS took over Enron's natural gas and power trading operation and Enron Online. With little volatility to trade around, UBS started firing traders and switched off the Internet trading platform. By May 2003, it had closed the Houston operation.[6]

Between the end of 2002 and the beginning of 2005, two dozen companies would settle over thirty CFTC complaints of market manipulation or attempts to manipulate the natural gas market with fines running in excess of $4 billion. The cases involved:

- the misreporting of information about storage, pipeline capacity and both the quantity and price of natural gas trades;
- abuse of affiliate relations;
- the improper sharing of insider information; and
- manipulation and charging of illegal prices.

These are the trading market abuses. In addition, there are a number of securities violations proven and pending.[7]

2. Public Policy Opens the Door to Abuse

The biggest long-term change in 2000 was not the spike in natural gas prices, however, it was the passage of the Commodity Futures Modernization Act (CFMA). While the CFMA did not change the legality of many of the activities that were taking place, it made it more difficult to detect them and it opened the door to many other types of transactions that raise concerns. As one analyst put it:

> What did the Commodity Futures Modernization Act (CFMA) of 2000 do?
>
> First, let me point out that the over-the-counter market in derivatives has never been adequately regulated. The market emerged only recently, and most of its

growth has occurred in the past fifteen years. At first, this market was largely ignored by regulators, and after it grew to a size that demanded it be addressed, the regulators found it difficult to define the line of jurisdiction over the markets because of poorly written laws and richly endowed political opponents to such regulation.

Before passage of the bill in December 2000, the government retained authority over fraud and manipulation in the over-the-counter derivatives markets. In addition, market participants were restricted under Rule 35 from conducting over-the-counter markets like an exchange.

The CFMA was a major bill that drastically reduced the level of prudential regulation of derivatives markets. It reduced transparency and the government's surveillance abilities over exchange-traded derivatives, and it completely eliminated or "excluded" federal derivatives regulation of the over-the-counter market. Enron operated in that completely deregulated environment.[8]

This concern about the deregulation and lax regulation of natural gas trading markets extends to consumers. For example, in pushing for reform of the Act, the American Public Gas Association argues

"Passage of the Commodity Futures Modernization Act of 2000 has significantly changed natural gas markets. As a result, we believe that the CFTC should be given additional authority to oversee and carefully monitor markets. Given the abuses in energy markets we have seen over the past several years, strong market oversight is more important than ever to protect consumers and ensure that markets are functioning properly.[9]

Large industrial users express similar concerns.

Natural gas traders on the New York Mercantile Exchange (NYMEX) were sharply criticized for "fostering high and volatile natural gas prices at U.S. consumers' expense" by Peter Huntsman, President and CEO of the corporation bearing his name… Mr. Huntsman charged, "hedge funds and other paper traders on the New York Mercantile Exchange continue to enrich themselves while U.S. gas consumers are forced to endure the result of the world's highest and most volatile natural gas prices….

Mr. Huntsman is "surprised" that more natural gas consumers are not "outraged" over the imbalance in the U.S. economy created by a "natural gas pricing system that has been out of control since Congress enacted the Commodities Futures Modernization Act in 2000."[10]

The criticism is not limited to users and their advocates. A similar sentiment was expressed in a 2005 article in the *Journal of Futures Markets*.

> Many scholars have recognized the cash-settlement manipulation problem, but few have formally addressed it. The lack of interest may have been due to the fact that, until recently, most U.S. exchange-traded cash settled derivative contracts were based on broad indices of very liquid stocks. Manipulation of such instruments requires very large trades that are costly to make and easy to detect through conventional surveillance.
>
> The prospects for manipulation increased substantially with the passage of the Commodity Futures Modernization Act of 2000 (Act). The Act authorized trading in single-stock futures and narrow-based index instruments, and the Act specifically permitted cash settlements. These new instruments will not necessarily have liquid underlying securities. Further, all else equal, fewer numbers of securities will be easier to manipulate than larger numbers.[11]

The over-the-counter derivatives market in natural gas is a derivative that rests on a narrow base, whose liquidity at key moments is unclear, and which is subject to no surveillance whatsoever.

The very high prices (by historical standards) of 2000-2001 were not sustained. By the winter of 2002 the national economy was in a recession. The Enron-generation of energy traders was slipping into bankruptcy. The market evaporated in mid-2002 under the suspicions of manipulation and fraudulent accounting.

B. Act Two: Reaping the Whirlwind

1. Trading Ramps Up and Prices Follow

The trading aspect of the electricity and natural gas industries quickly returned to the relative safety of trading around assets and marketing activities.[12] These behaviors are derisively called a "flight to quality."[13] Perhaps not so coincidentally, prices moderated in 2002, declining by 25 percent on average, but settling about 50 percent higher than the decade of the 1990s. The relationship between crude oil prices and natural gas prices had moved back toward the average of the 1990s.

For some, the collapse of Enron Online and the merchant traders represented a loss, even a crisis.[14] To speculators and traders who believe that everything that can be traded should be, as often as possible, this looks like an alarming situation of illiquidity. By late 2003 the big banks and large speculators began to enter and accelerate trading to deliver the consumer from the doldrums of slow, stable prices.

It appears that trading activity began to revive in late 2003 and price began to lift off again.

> Wall Street banks are notoriously fickle about their commitment to commodities trading. But the eye-popping profits earned by the market leaders, Goldman Sachs and Morgan Stanley, have spurred other banks to get into the game. In 2004, Goldman Sachs and Morgan Stanley earned about $2.6 billion combined from commodities trading, most of that from energy.[15]

The massive influx of hedge funds appears to have ramped up in mid-2004 followed by the 2005 skyrocketing of prices.

> The new hedge funds are sucking scarce talent away from the banks. At least 450 hedge funds with an estimated $60 billion in assets are focused on energy and the environment, including 200 devoted exclusively to various energy strategies.[16]

In the post-Enron period the rules of entry were relaxed to let more entities into these lightly regulated or unregulated markets.

> Some lawmakers and consultants argue the government has done little to shore up the energy markets most susceptible to manipulation. The Federal Reserve relaxed rules in 2003 so that Commercial banks like Citigroup would take possession of physical commodities like oil in storage tanks… The move allowed the banks to serve as dealers in commodity derivatives…
>
> "It is an effort by banks to move into the terrain that Enron abandoned in their bankruptcy…
>
> As early as October 2002, less than a year after Enron declared bankruptcy, the Commodity Futures Trading Commission started to write rules exempting commodity hedge funds from regulatory oversight.[17]

Finding detailed data and analyses of the movement of hedge funds and banks into energy trading is difficult, since little official information is gathered, not to mention reported. The following relies on a series of analyses published over the course of a year by UtiliPoint International and Global Change Associates, who announced a "multi-client study on the Hedge Funds entry into energy trading markets" in a note published on July 15, 2004. The numbers track well with other accounts.

After a hiatus of a year or so, the volume of trading increased dramatically and by mid-2004 it had returned to the level reached at the point of the collapse of the Enron generation of traders. This time trading was dominated by a completely new set of players – investment bankers and multinational oil and gas companies. As trading and prices began to mount, the hedge funds moved in. It appears that the number of energy hedge funds increased from about

100 to over 400,[18] and those specializing in energy commodity trading increased from 10 to over 200.[19] The volume of trading in over-the-counter markets has exploded. One estimate of over-the-counter trading through a NYMEX platform shows a sevenfold increase between June 2003 and June 2005.[20]

While the analysts who hype the energy trading are adamant that this liquidity is good for the markets, they at least admit that it might "accentuate" upward trends. However, their descriptions are a cause for even greater concern.

> Hedge funds bring increased sophistication, liquidity, and the risk culture and trading acumen to bear on energy commodities markets. Seeking new opportunities to obtain greater returns, hedge funds see energy markets as providing that opportunity. Likewise, the investment banks have a risk trading culture, deep pockets, and access to both physical and financial traders. Even the energy companies with surviving trading arms are now partnering with investment banks to sustain and improve trading operations while obtaining access to increased expertise, more sophisticated tools, and risk capital. Moreover, we have the multinational oil and gas companies with the balance sheet to put their capital at risk. It is no accident that BP is the No. 1 gas trader and in the top five in power trading. BP has the balance sheet and supply to play in this new financial market.[21]

While analysts debate which approaches are the most profitable for new traders entering the market, there is no doubt that the influx has been massive.

> NYMEX gas futures trading underwent a fundamental shift in 2005 as speculators jumped into the market, intent on harvesting big profits from the surge in volatility, several analysts agree.
>
> Peter Fusaro, co-principal of the Energy Hedge Fund Center, said last week that conventional gas traders such as utilities have been sidelined over the past year as speculators have increasingly "financialized" the gas market.
>
> Funds held more than 50% of the open interests in the NYMEX Henry Hub contract at year's end, Fusaro, said, which he called evidence of "structural change in energy commodity trading."
>
> He said that, because hedge funds thrive on volatility, the market has become faster-moving – and harder to predict…
>
> And Fusaro said hedge funds' interest in energy commodities is likely to grow even more in 2006, potentially making trading a riskier proposition as the amount of money changing hands increases at a quicker pace.

> Citigroup Global Markets analyst Kyle Cooper agreed with Fusaro that there has been a substantial shift in the market due largely to the increased presence of non-commercial traders.
>
> "The magnitude of the changes is quite dramatic and very significant," Cooper said. AWhat must be taken into account is what kind of risk you think you have at stake. The magnitudes of the moves are certainly phenomenal. Historical comparisons are thrown out the window."[22]

When risk capital seeking higher returns starts to chase a commodity like natural gas that is relatively fixed in supply and demand in the short and mid terms, it is hard to imagine that it will not have an impact on prices. Most attention was still focused on oil because that was a more mature market, but the effect was seen as spreading to natural gas.

> More than 200 hedge funds already play or are set to play in energy commodities markets, and they are primed to bring more risk capital to bear in those markets. Evidence of their trading activities is already speculated to account for the much higher crude oil prices seen in recent months, and some analysts suggest that hedge fund activity may account for up to $8 per barrel of total price. Additional evidence of their influence has been the 55% growth in open interest on NYMEX crude, heating oil, and gasoline contracts over the past year and the more violent and volatile intraday trading during recent months. What happened in oil has spread to gas, power, and coal.[23]

The figure of $8 per barrel as a "hedge fund activity premium" in oil is a stunning number for mid-2004. It represents approximately 20 percent of the refinery acquisition cost in 2004 and two-thirds of the $12 increase in refinery acquisition costs between 2002 and 2004. Below, I discuss a study prepared for the U.S. Department of Energy that suggests a disconnect between natural gas energy futures prices and the underlying resource costs of $2.30 per thousand cubic feet (mcf) of natural gas production costs. This figure is equal to about 20 percent of the natural gas wellhead price in 2006 and over 50 percent of the increase in natural gas wellhead prices between 2002 and 2006.

2. Growing Concerns About Trading

The opportunity to straddle a variety of markets is also being exploited by the new players. They can take positions in lightly regulated exchanges and unregulated over-the-counter markets, directly hold physical assets, and participate as large players in equity markets.

> However, even on this front, the oil companies seem to be lagging behind the speculators, as investment banks have already been active buying reserves in the ground.

> Many of the existing macro funds pursue long/short commodity trading strategies taking bets in a variety of markets… These funds tend to be larger and well-established with significant assets under management. Many of them are increasing their exposure as the trend in energy prices is upward taking long positions. Some of the macro funds engage in playing the spread between commodity markets and equities going long on energy commodities and short on energy equities for example.
>
> Indeed, early returns suggested for many of these funds from energy commodity trading have been spectacular (one fund that we know of has reported 240% returns to date in 2004) and only serve to attract other macro funds to bet some of their assets in energy markets as well. [24]

Chasing high profits in the energy sector in markets that lack transparency increases risk, which demands higher returns.

> What is readily apparent from all of this activity is that the fund community now sees the energy complex fundamentals trending to higher prices and that it offers them an attractive sector in which to inflate sagging returns for investors.[25]
>
> Plainly, the entrance of hedge funds is reigniting the energy trading phenomena. By increasing liquidity through the introduction of additional risk capital and by improving the counterparty credit situation with strong balance sheets, the funds are providing the market some positives. However, the lack of detailed physical energy knowledge and reliance on black box models by some in the hedge fund community combined with the lack of visibility into their activities ought to cause some unease and concern. The last thing the energy markets need is yet another speculative trading-led implosion.
>
> Those that get it right most of the time are the multi-national oil companies and the two big investment banks – Morgan Stanley and Goldman Sachs….
>
> Except for a handful of funds, they just can't stack up against the great oil trading companies like Vitol or BP and the investment banks, and since energy trading is a zero sum game, the wealth transfers could be massive. Count on more great quarters for Morgan Stanley's and Goldman Sachs' commodity shops. The other investment banks such as Merrill Lynch, Barclays, Bank of America and Deutsche Bank are now playing catch up.

This prediction of increasing profits made in October 2004 proved quite correct. The bonus pool at Goldman Sachs, one of the key members of the "triangle of trading," has raised some eyebrows. This activity simply cannot be costless.

> The bonus pool, as we've heard ad nauseam, is overflowing with some $11 billion. Mr. Paulson, the chairman and chief executive, alone took home 437 million, or about 800 times the median household income in the United States. Well done. The question is whether all of this is sustainable – and, of course, whether the bank hasn't turned into a huge hedge fund.[26]

By mid-year 2005, given the lack of regulation and the huge sums of money changing hands, even the most ardent defenders of commodity trading became a little worried.

> We see the potential for a looser regulatory regime and collision course with Sarbox passé during the height of media attention on the scandals…. But, actually, pragmatic regulation is a good thing… Government at all levels clearly failed in the Enron/Energy Merchant scandals….
>
> So what's the impact on energy markets? We are fearful of more "unruly" traders starting up their old tricks again. During this spring, one gas trader was front running overnight electronic gas markets on NYMEX's Access, which is a NYMEX vulnerability. We don't see adequate market surveillance and enforcement from either the SEC or the CFTC. We expect more hedge funds to blow up (some already have) in energy commodity trading and unfortunately more phantom and wash trading, i.e. "market manipulation." This goes back to how traders are incented in the first place.
>
> It's really not necessary to create an environment in which criminal activity may flourish again as we are in the midst of the greatest commodity bull market for natural resources of all time. The fundamentals of this demand-driven market will drive us to higher highs and much more price volatility. But a good friend in New York once told me that commodity traders were the "lowest form of life" (he is still one), and I would add New York real estate brokers to that list too. Gordon Gekko, the character in the movie Wall Street, sums it up, "Greed is good." There is never enough money to be made. It has much more to do with ego than money!
>
> We just hope that any further issues don't rain on everyone's parade and that politicians such as Senator Feinstein keep talking and do not take action on real regulation of the OTC derivatives market. If that occurs, all this business will flee to offshore accounts. In fact we are hearing that more and more hedge funds are moving in that direction setting up Cayman Island, Nassau and other vehicles to protect themselves from US financial disclosure. We are in the ramp up stage for energy hedge funds and we are becoming convinced that there is a real business in a "due diligence" service of these startups.[27]

The NYMEX Henry-Hub natural gas price for May, the month before the above piece was written, averaged a little over $6.50/mcf. That was just about the average for the first four

months of 2004. For December 2004, it was just under $7.00. In December 2005, the spot price averaged close to $14.

Before Hurricane Katrina, the NYMEX futures market had already lost touch with the physical market. Market trends throughout the year were causing consternation among analysts.

> First, until the mid-November cold snap, spot prices throughout North America were a minimum of $1-2/mmbtu below the Henry Hub prices, and as much as $4-5 lower in the Rockies and points further north and west. While large discounts to spot are common in the Rockies and Western Canada (because of limited take-away and storage capacity), the existence of any discount, let alone a large discount at points like New York Citygate or the Chicago Citygate, is highly unusual. Midwestern and Northeastern discounts to Henry Hub literally mean that if transportation were costless and instantaneous it would be profitable to ship natural gas from the major load centers to Southwest Louisiana.[28]

With hundreds of billions of dollars at stake and a vital commodity gyrating wildly in price around a dramatic upward trend, one would think that policymakers would examine these markets closely, but that is not the case. As a recent analysis from a hedge fund analysis firm, entitled "Hedge Funds Change Energy Trading," pointed out,

> Historically, most hedge fund managers have not been required to register with the U.S. Securities and Exchange Commission (SEC) and, therefore, have not been subject to regular SEC oversight…
>
> Further, hedge funds are not subject to the numerous regulations that apply to mutual funds for the protection of investors, such as those requiring a certain degree of liquidity, the ability to redeem mutual fund shares at any time, the protection against conflicts of interests, assurance of fairness in the pricing of fund shares, disclosure regulation, the limitation in the use of leverage, etc…. The recent SEC financial disclosure requirements are really light-handed regulations used to assuage public concerns over financial markets and have had little impact on hedge fund investment.[29]

Ironically, for analysts, the unregulated nature of hedge fund trading makes it difficult to estimate how much activity is taking place.

> While the CFTC data shows futures and options positions on the NYMEX, it does not reflect the OTC energy markets at all. This is still where most oil and gas trading takes place. Futures dominate short-term trading while the OTC markets dominate the long-term energy markets. Moreover, a trader may be classified as "commercial" in some commodities and as "non-commercial" in others. It has shown a rise in "non-commercial," indicating some of the funds

> presence, but quite frankly, funds also trade through banks. We therefore feel that the data is only showing the tip of the iceberg in terms of the real presence of fund trading which will continue to grow.
>
> The relatively secretive and unregulated nature of the funds and their activities help to cloud an assessment of their true level of activity.[30]
>
> The liquidity provided by the hedge funds is evidenced on the front end of the markets through both NYMEX and IPE oil and gas futures trading, but is much more established in the OTC energy markets. Like the hedge funds themselves, these markets are not price regulated, and have a degree of price opaqueness.[31]

3. A Broader Pattern of Abuse in Energy Markets

Natural gas markets share this pattern of abuse with other energy markets. Unilateral actions by any of a number of individuals in any of a number of circumstances provide a landscape in which upward price movements are probable. "There are regular squeezes in the Brent [oil] market… The whole trick is to collect more money in CFDs [contract for differences] than you lose on the physical squeeze… People seem to do it in turn. It depends on who's smart enough to move in a way nobody notices until it happens."[32]

> In a case brought by a private party in late 2001, the practical reality was revealed.
>
> Tosco won a settlement claiming that Arcadia Petroleum (a British subsidiary of the Japanese firm Mitsui) engineered an elaborate scheme to manipulate oil prices in September of 2001 through the use of OTC derivatives and a large cash market position to corner the market in Brent crude oil. As a result, the price of Brent crude soared between August 21st and September 5th and pushed its price to a premium over West Texas Intermediate crude oil (WTI)…
>
> *Dated Brent, which acts as a price marker for many international grades, is physical crude traded on an informal market, rather than a regulated futures exchange. This lack of regulation poses problems for oil producers and consumers seeking a fair price… A typical Brent squeeze involves a company quietly building a strong position in short-term swaps called contracts for difference, or CFD's, for a differential not reflected in current prices. The company then buys enough cargoes in the dated Brent market to drive the physical price higher, which boosts the CFD differential…*
>
> *The Company may lose money on the physical side, but it's more than compensated for by profits on its offsetting paper position in the short-term swaps market.*[33]

These abuses persist in markets that are actually more difficult to move than natural gas markets. For example, in January 2006, the CFTC reported a settlement in oil trading:

> The CFTC said that it found that, on at least five occasions from November 2003 to March 2004, traders for Houston-based Shell U.S. Trading & Shipping Co. executed prearranged and noncompetitive trades in crude-oil futures contracts in violation of exchange rules. In each instance, the regulator found, Shell traders agreed to swap a prearranged quantity of oil-futures contracts in the same month…
>
> The CFTC said that none of the prearranged trades included prior agreements on pricing for the contracts, thus distinguishing the transactions from so-called round-trip, or wash, trades…
>
> Heavy wash trading in the natural gas market in the U.S. earlier in this decade undermined the credibility of that market. Oil-futures, however, are more liquid, making it much more difficult for isolated trades to distort prices. In late 2003, BP PLC agreed to a record $2.5 million fine with NYMEX, settling charges of improper crude oil trading, including wash trading.[34]

Well after the headlines died down, this type of trading continues. Note that the parent corporations of the two entities mentioned in these complaints are two of the largest natural gas marketers, who account for almost one-third of the gas marketed in the U.S. *The Wall Street Journal* noted that the settlement of "the fines come at a time of popular resentment over steep energy prices."[35]

C. Moving Markets: Theory And Practice

Manipulation of markets receives a great deal of press attention and has been a prominent feature of energy markets in recent years, while the legal literature focuses on manipulation very narrowly defined as "the exercise of monopoly or monopsony power in a futures market (or more generally a derivative securities market) and/or the cash marker for the underlying commodity near the expiration data of the future (derivative security)."[36] However, there is a broader range of behaviors that are a concern.

> Manipulation in the commodity futures markets takes many forms. They may be manipulated through rumors or false information conveyed in the market. Prices may also be manipulated through rigged trades or the use of "capping" or "pegging," by which market prices are set at artificial levels for margin purposes, price setting and other reasons.[37]

Whether or not all of these behaviors violate some statute, they can have an effect on prices and pricing behaviors. In fact, virtually every one of this list of horribles has been alleged to have occurred in energy markets in the past decade, as illustrated by consent

decrees, fines and court cases. Given the importance of natural gas as a commodity and its inherent vulnerability, a very broad range of practices that can move prices should be a concern. Thus it is important to identify different categories of behavior and "[I]t is essential to distinguish the exercise of market power near expiration of a futures contract from the effect of large trades that move prices."[38] Moreover, circumstances in which traders can exploit shortages should also be a source of concern.[39]

The important point, however, is not that these behaviors take place, but that the structural conditions that make them possible are very deeply engrained in energy markets and have a broad impact on prices. The factors identified as making manipulation more or less likely also enable other malevolent behavior while making markets more susceptible to price peaks. There are a variety of structural and behavioral ways that financial commodity markets can push prices up. Volatility and churn can be costly. Brokers take fees and traders take a spread on every transaction. Volatility increases risk, which then demands rewards. Producers, in turn, want volatility insurance. If each of these factors creates a small increase in price, it adds up to substantial increases given the amount of money involved.

Other structural factors may play a part in raising the consumer's price. Different players enter the market with different incentives and under different constraints. While there is a winner for every loser, it may well be that those who are in the market to procure gas for actual consumption are at a disadvantage. They need to keep the house warm, while financial players are only in it for the money. Given the experience of recent years, the ability to move the market, legally or illegally, simply cannot be dismissed. The line between what is legal and illegal is quite unclear.

The underlying dynamic in the natural gas market is between physical consumers, who are short – they need to buy supply to keep the house warm – and the physical and financial seller, who are long. They have commodities, or promises that they will deliver them.

> Shorts must pay current owners of the commodity increasingly higher prices in order to compensate current owners of the commodity for the surplus foregone.
>
> When friction exists, shorts must bid up the price in order to increase the number of deliveries as the current owners of the commodity anticipate that they will incur search costs themselves or forgo some consumption.[40]

Volatility and volume, which are lauded as a demonstration of liquidity in the markets, also have a dark side. They open the door to abuse.

> In a commodity futures market in contrast, the victims of market power create their own downfall by trading with the manipulator; if they did not trade with him on a large scale, he could not accumulate the large positions that allow him to exploit frictions in the delivery end game.[41]

> [A] trader who does not possess any informational advantage is able to acquire market power as long as the flow of the orders from other traders to the futures market is sufficiently volatile and large relative to the size of deliverable supply… Put another way, the existence of "noise traders" makes fraud possible.[42]

Volatility also raises the cost of gas by building in a premium.

> Increased volatility increases the value of producers' *operating options*, options to produce now (at an "exercise price" equal to marginal production cost and with a "payoff" equal to the spot price), rather than waiting for possible increases or decreases in price. These options add an opportunity cost to current production: namely, the costs of exercising the options rather than preserving them. This and increase in volatility increases the opportunity cost of current production.[43]

The extreme volatility of the market and its vulnerability to price spikes, exploitation of tight conditions, and manipulation can be seen in the reaction to news and events. "Volatility around the time that the gas storage report is released is considerably greater than normal."[44] We should not forget that "normal" in natural gas is an already high level of volatility. In 2004 there was a notorious incident in which a misreported storage number drove prices up sharply.[45] Although the Federal Energy Regulatory Commission concluded that the mistake had been inadvertent, it underscores how vulnerable these markets are.

There are strands in the technical literature, particularly on energy, which support a number of propositions that lie at the core of the concern about the recent behavior of the natural gas market. These markets are inefficient, allowing supranormal trading profits.[46] Increases in volatility lead to higher risk premiums.[47] Increased volatility results in lower production as producers exercise their option to hold assets in the ground.[48] Increases in volatility drive spot prices farther above futures prices.[49]

This is not to suggest that there is unanimity in these interpretations. Indeed, the technical analysis of natural gas prices is all over the map:

- positive and negative net hedges,[50]
- positive and negative betas, [51]
- efficiency and inefficiency in price discovery.[52]

In short, the technical literature sheds little light on how this market works. The important point here is that one cannot assume that the market is "working" just because it is a market. There are structural conditions that may impose inefficient and unnecessary costs on consumers, exploitation of tight markets, and opportunities for abuse.

This basic proposition is true of the broader literature on financial markets. There are strands in this literature that identify potential and actual abusive practices. Many of these are directly relevant to the natural gas market, including:

- manipulation facilitated by large positions[53]
- lack of transparency,[54]
- structural advantages enjoyed by large traders,[55]
- the exercise of market power,[56]
- insider trading[57] and self-dealing,[58]
- trading practices that accelerate market trends,[59] perhaps causing them to overshoot.[60]

> The academic literature focuses on fairly sophisticated transactions.
>
> Cash-settled derivative contracts are susceptible to manipulation. Manipulative traders may profit by taking large positions in the contract and manipulating the underlying cash settlement price. Whether such manipulations would be profitable depends on whether the cost of manipulating prices in the underlying markets are less than the benefits of making favorable cash settlements.

The citations above come from an article that makes the case that position limits are necessary in these markets on the basis of very sophisticated situations in which surveillance will be a challenge. These manipulations rest on taking sophisticated contrary positions in different markets. Actions that appear as losses in one market are actually more than compensated by gains in another market. The complex types of manipulation that this sophisticated analysis identifies are different from the more blatant types of manipulation that attract headlines. The support for limits stems from the fact that oversight alone cannot detect abusive trading practices. The complex theory is as follows:

> If manipulations were easily identified, increasing surveillance efforts would be sufficient to reduce manipulations by increasing the probability of detection and subsequent prosecution with regard to the narrow-based derivative contracts. Successful prosecution of manipulation, however, is difficult, because prosecutors must prove manipulative intent (scienter). Manipulators may avoid liability by offering plausible alternative explanations for their trading in the underlying securities. The most plausible such alternative is that they traded the underlying securities before expiration to ensure that they would not lose their economic positions in the underlying risks when the contracts expired. Because this explanation generally is plausible, surveillance

> coupled with prosecution may not provide an adequate safeguard against true manipulation.[61]
>
> Position limits directly limit manipulation by limiting the size of derivative positions that would benefit from manipulative practices. Position limits can potentially improve economic efficiency by reducing manipulation in a less costly manner than surveillance alone. However, they can be set too high or too low.[62]

Unregulated markets make the problem particularly acute. With huge sums being traded in these unregulated markets, regulators do not know what is going on. It is also the case that trading, even without manipulation, can have negative effects on the market and specific types of players therein.

> Even when the settlements of cash-settled contracts are not purposefully manipulated, the settlement mechanism may increase underlying volatility when hedgers unwind their hedges if they have no incentive to control their trading costs. This generally is the case when hedgers trade out of their positions at the same prices that determine the final cash settlement price. The resulting price uncertainty reduces trading by risk-averse producers and thus produces deadweight losses.[63]

While analysts tend to disregard the wealth transfers and focus on macro efficiencies, the transfers matter a great deal to residential consumers. Similarly, if the agents of residential consumers, local distribution utilities, are the risk-averse players in the market, consumers will bear the burden of their loss as well.

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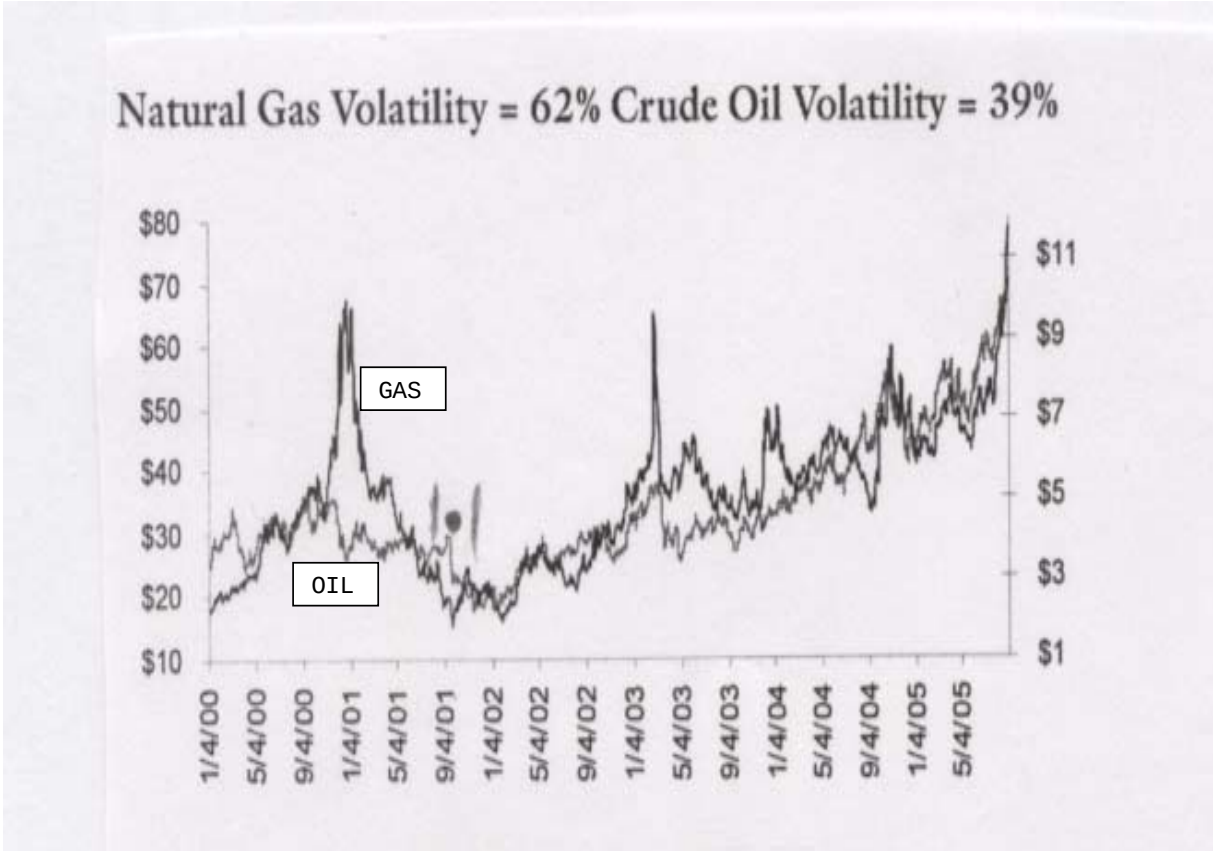
IV. UNCERTAINTIES ABOUT THE FUNCTIONING OF NATURAL GAS MARKETS

A. Volatility, Risk Premiums and Efficiency

The potential impact of volatility and risk on prices is a major concern in energy commodity markets. Volatility and risk premiums are substantial and have been increasing over time.[1] In an analysis whose data ends in 2002, Pyndyck concludes that the Enron scandal added a "marginally significant" 1.5 percent to an average volatility of 20 percent. He concludes that the increase "has little economic importance."[2] The peak volatility for the July 2000 to July 2002 period in Pyndyck's analysis occurred on September 26, 2001, at the height of the Enron troubles. Be that as it may, the change since has been dramatic (see Exhibit IV-1). After the quiet period of 2002, volatility increased in 2003 and both prices and volatility have increased since. The economic significance is much greater.

EXHIBIT IV-1: NATURAL GAS PRICE VOLATILITY: SINCE THE TURN OF THE CENTURY

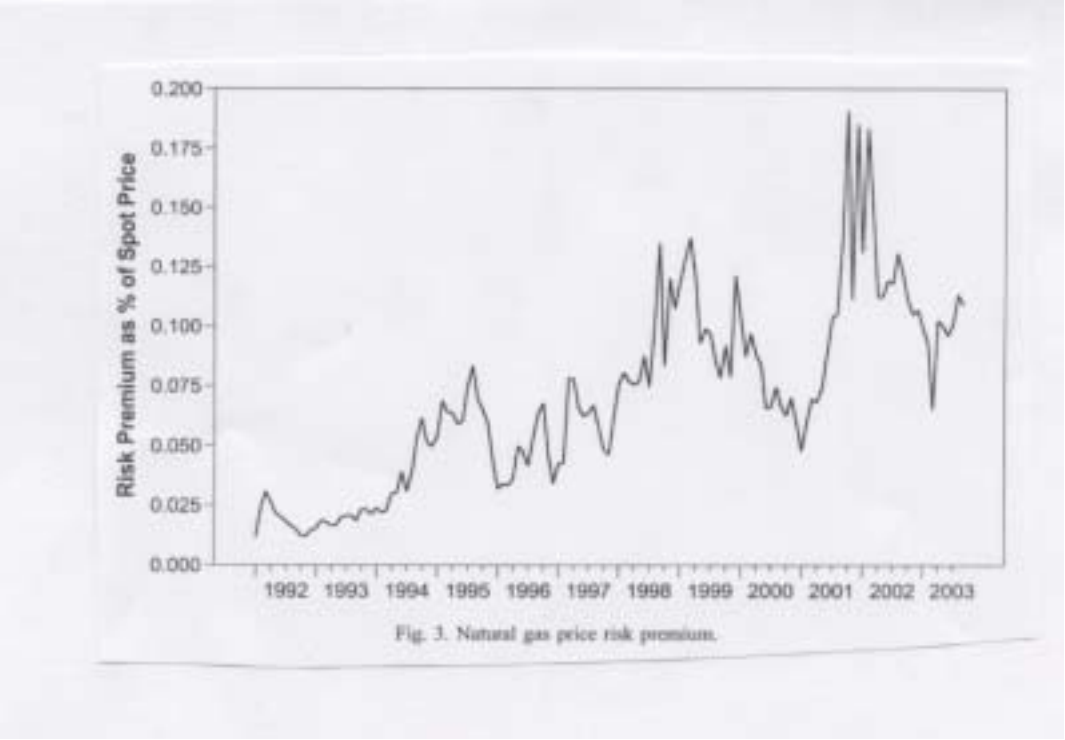


Source: Servnek, Matthew, "What You Need to Know Before Investing in Energy," *The*

The risk premium analysis parallels the price analysis described earlier in that the advent of Enron trading saw a sharp jump over a long-term upward trend, then a reduction with the demise of Enron (see Exhibit IV-2).[3] Unfortunately, the analysis did not include data for 2004 and 2005.

> The estimated risk premium seems to be positive throughout the sample period and the average value of the risk premium appears to be economically significant, ranging from 3% to 11% of spot prices. The hypothesis of zero mean risk can be rejected at high significance levels for all the sample periods. The risk premium appears to be increasing over time especially towards the end of the period [2000-2003].[4]
>
> Bias could be interpreted as the risk premium required by the market participants for bearing the systematic risk of natural gas price movements.[5]
>
> This bias reaches about 10% per year. A speculator would earn this rate of return on average going long in the natural-gas futures. Such speculation would of course be quite risky judging from the size of the error variances.[6]

EXHIBIT IV-2: THE NATURAL GAS MARKET RISK PREMIUM



Source: Song Zan, Chiou Wei, and Zhen Zhu, "Commodity Convenience Yield and Risk Premium Determination: The Case of the U.S. Natural Gas Market," *Energy Economics,* forthcoming.

The finding of a "bias" in the natural gas market can be related to structural factors that work to the detriment of consumers since, "for regulatory reasons the buyers that are comprised of power producers as well as electricity and natural gas distribution companies may not have enough incentives to hedge their risk."[7] Friction in the market may also affect the pattern of prices since "due to locational basis risk, the buyer's incentives to hedge price risk may be dulled."

> Market participants with rational expectations predict the direction of spot prices most of the time, but require a risk premium to take a position. For example, a buyer might correctly expect the spot price to decrease at Henry Hub. However, due to uncertainty about transportation conditions the buyer might still require a risk premium in buying futures. Similarly, the fact that a producer expects prices to go up does not mean that s/he would be willing to sell futures at the expected future spot price.[8]

In theory, spot commodity prices should track futures prices reasonably closely in properly functioning markets, particularly as the date for the settlement of the future contract approaches.[9] Futures prices should reflect market fundamentals, above all the cost of producing the commodity, since high futures prices should elicit more supply that drives prices down.

In practice, recent U.S. government reports demonstrate that this is not the case in the natural gas market. Natural gas prices simply do not track with futures prices properly and the disconnect has been growing. The disconnect tracks on the high side – to the expense of consumers and the benefit of producers and traders – and it has been widening.

A report from the U. S. Energy Information Administration (EIA) concluded that "prices of natural gas futures contracts expiring during the past three heating seasons (2002-2003, 2003-2004, 2004-2005) generally did not perform well as a predictor of realized spot prices at the Henry Hub."[10]

While spot prices are a poor predictor of futures prices, the Henry Hub spot prices are a very good predictor of the wellhead price of gas. Thus, there is a disconnect between futures prices and wellhead prices. The disconnect is important because of the role these futures prices play.

> However, as an indication of market expectations concerning prices in the future, some industry and market participants tend to use the prices for futures contracts as predictions of commodity prices that will be realized in subsequent months, although NYMEX itself does not explicitly encourage this view…
>
> Comparing monthly futures and spot market prices allows an examination of current market conditions on price expectations and provides a basis to assess the performance of futures prices as a predictor of spot prices.

> The price movement patterns for the 2004-2005 heating season contracts differ from those for the 2002-03 and 2003-04 heating season contracts, as the futures diverged from the Henry Hub spot price. This is further evidenced by the lower correlation coefficients…[11]

> Industry analysts have also come to question the role of the Henry Hub price.
>
> Cambridge Energy Research Associates, in a report issued to clients Sept. 23, said Henry Hub, despite its key role in the delivery point for the NYMEX gas futures contract and the reference point for basis deals and various other physical and financial trades, "is increasingly an imperfect indicator of the average price that North American producers receive…
>
> CERA found that the average price at Henry Hub is increasingly higher than the price received by North American gas producers. In 2000, the Henry Hub price average 18 cents/MMBtu above the production-weighted average supply price; for the 12 months ending August, that premium had grown to 50 cents/MMBtu, according to the report.[12].

Similarly, a report from Lawrence Berkeley National Laboratory (LBL) concludes that futures prices are far above projections of the cost of production.[13]

> As was the case in the past five *AEO (Annual Energy Outlooks)*, we once again find that the *AEO 2006* reference case gas price forecast falls well below where NYMEX natural gas futures contracts were trading at the time the EIA finalized its gas price forecast."[14]

It is important to note that when LBL began analyzing the disconnect between the EIA numbers and the NYMEX numbers, the EIA "characterized their efforts as *projecting* natural gas *costs* rather than *forecasting* natural gas prices."[15] Future prices do not have to perfectly track production costs, but when the disconnect becomes large there is cause for concern. The EIA projection for December 2005 showed a very substantial disconnect.

> In fact, the NYMEX-*AOE 2006* reference case comparison yields by far the largest premium — $2.3/MMBtu levelized over five years – that we have seen over the last six years. In other words, on average, one would have to pay $2.3/MMBtu *more* than the *AEO 2006* reference case natural gas price forecast in order to lock in natural gas prices over the coming five years.[16]

The premium is a huge number, equal to more than one third of the estimated cost of production. It amounts to almost $48 billion on an annualized basis, or about $4 billion per month. For a household heating with natural gas in the Midwest, it would add about $200 dollars to this winter's heating bill. Moreover, this figure is levelized over five years. The current and near term disparity is even larger than that, perhaps over $5.00/MMBtu. As pointed out earlier, it accounts for a large part of the increase in natural gas prices since 2002.

These figures alone are enough to command the attention of policymakers and the public. But the fact that the disconnect between costs and prices is not an anomaly makes it even more troubling.

Most commodity market analysts are unwilling to question the workings of these markets, except in the most extreme examples of market manipulation – blatant attempts to corner the market or fraudulent reporting of prices. Thus, after the EIA concludes its empirical analysis that finds the market is not doing what it should, it restates the common faith in the marketplace:

> However, trading in futures contracts provides benefits to market participants by providing some degree of price certainty, market transparency, and liquidity. In addition, trading in futures contracts is an important tool in an array of options for gas managers to consider in establishing their supply transaction portfolios. The availability of futures markets allows each gas manager to optimize his portfolio relative to his situation. As such, trading in futures contracts is expected to remain an important tool for managing price risk.[17]

Repeating the dogma, without further analysis, begs the question of whether the failure of markets to send sensible signals about prices undermines or diminishes their usefulness.

The LBL analysis takes the next step, because the authors are less concerned about whether the market price is "right" and more concerned about what market players do with the various predictions of price. Their concern was focused on the fact that electricity generators and public utility commissions were using the projected natural gas costs as a basis for making decisions about what types of generation to install. To the extent that the estimates of natural gas costs were no longer reliable predictors of natural gas prices (on the low side), gas generation facilities were being systematically and incorrectly favored at the expense of other sources of power. In this regard, the fact that there was a gap between mid and long-term projections of natural gas costs and market prices is itself important. Even if the gap could be "justified" on some systematic economic basis, it still argued for consumers (and their agents) to look at it differently in making their choices.

This review of the explanations suggests we really do not know a great deal about how natural gas markets work. It is a truism of commodity markets that the positions have to add up. For every buyer there has to be a seller and for every molecule that someone is committed to buy, someone has to be committed to sell. While this simple truism is frequently offered to support the claim that the market price is right and to allay fears that something is wrong, it actually explains nothing. The questions are who holds which positions, and with what systematic, strategic, tactical or nefarious tactics will they influence price?

Some of the explanations suggest that this is just "how the market works," but that does not mean it is working very well from the consumer point of view, nor does it mean the situation is helpless. If these are systematic factors that tilt the playing field against consumers, policymakers can take steps to restore the balance.

Some of the explanations involve claims that the market is not working, because it is subject to strategic behavior, tactical exploitation and manipulation that drive prices up. Here, there is little doubt that we need public policy to set things straight.

The claim that markets are beneficial because they create liquidity is not an absolute statement. It must rest on empirical facts and conditions, several of which are important for natural gas consumers.

First, if the commodity and the institutional structures under which consumers (or their agents) buy gas in the market systematically place them at a disadvantage, the market will not work well for them. Their costs will rise, not because of the costs of the underlying commodity, but because of the workings of a hostile market. Second, the market may be vulnerable to manipulation. Third, the commodity market does not necessarily contribute to solutions to underlying physical problems.

> If, in aggregate, natural gas producers are less concerned about hedging than are natural gas consumers, then there will be *negative net hedging pressure* – i.e. more hedgers seeking to buy futures contracts than there are seeking to sell them – and speculators will require compensation in the form of futures prices that are *above* expected spot prices.[18]

In terms of the quantity of gas traded, the finding was unclear. "Though largely positive over this period, net hedging pressure clearly swings around quite a bit, and is negative at times."[19] The finding in terms of the number of traders was quite different, which may compound the problem faced by consumers of natural gas.

> In terms of the number of traders, net hedging pressures have been primarily *negative* over this period. This dynamic – largely positive net hedging pressure in terms of open interest combined with largely negative net hedging pressures in terms of the number of traders – suggests the presence of a few large natural gas producers, and a greater number of smaller (in aggregate) natural gas consumers, hedging their respective positions. It is not clear whether this implied market composition has any bearing on the premiums observed in … this paper, an interesting question might be to examine either information asymmetry [or] transaction cost theory…
>
> What if producers benefited from volatility, while consumers were hurt by it? In this case, producers would require compensation (i.e. a premium) for being locked into long-term fixed contracts and consumers would be willing to pay such compensation. Economic theory provides some support for this very scenario…
>
> If gas prices, and therefore consumer expenditures on gas, rise as the stock market declines (e.g. because rising gas prices hurt the economy), then natural

> gas is said to have a negative "beta" and is risky to gas consumers and beneficial to gas producers….
>
> In this specific case, where gas with a negative beta is risky to consumers and beneficial to producers, consumers have an incentive to hedge natural gas price risk, while producers do not. Intuitively, it follows that even if both consumers and producers share identical expectations of future spot gas prices, then producers would still require – and consumers would be willing to pay – a premium over expected spot prices in order to lock in those prices today.[20]

Each of these configurations cuts against the risk averse residential ratepayer. Moreover, the advantage of the large producers has been noted by market analysts. The large producers have greater flexibility to hold out for higher prices and take advantage of the direction of prices.

> "[T]he E&P firms he covers are approximately 24% hedged for 2006 and only 10% hedged for 2007. Those levels are "pretty light" compared with several years ago when most were between 40% and 50% hedged.
>
> "Obviously, we have concern about gas prices in the near term given the weather. It doesn't surprise us that companies are locking in additional hedges," Tameron [of Jeffries & Co.] said. Even so, most companies "are still making a lot of money at $8/MMBtu and $9/MMBtu."[21]

The academic studies that suggest risk premiums and inefficient price discovery in these markets will strike a resonant chord with many market participants. Large users feel that this financial activity drives up prices and harms consumers.

> Ted Henry, chairman and CEO of Selma, Ala.-based Henry Brick, said his company's cost of gas last year "was 245% above the average of the 1990s."
>
> The volatility in the gas futures market makes it hard for industrial end-users to make bottom line decisions. "The traders need volatility. But it makes it difficult for us trying to use gas to produce a product." [22]
>
> "Government data released today (June 2)," Mr. Huntsman's statement said, show a record amount of natural gas in inventory for this time of year, and demand for gas remains flat. Yet in the last two trading sessions the price of gas on the NYMEX shot up more than 65 cents and closed up 44 cents. "On an annualized basis, that cost the U.S. economy between $10 billion and $15 billion." Why? Because, according to one analyst, "fund buying jumped in… and sent prices racing…" [23]

B. Fundamentals Versus Technical Trading

A tangent of this debate is the difference of opinions between market analysts over the role of fundamentals versus technical trading. Choukas-Bradley and Donnelly argue that technical trading dominates and drives prices higher.

> Trading of the natural gas contract on the NYMEX continues to be dominated by technical trading, with the result that in a period of stability in market fundamentals, the market will tend to see prices remain at high levels if they start at high levels, just as they would remain at moderate levels if they started at moderate levels. That is, part of what is propping up current prices is . . . current prices. While domestic producers have an incentive to hedge physical gas price exposure at prices equal to or above their full-cycle replacement cost (which includes their then-current competitive threshold return on invested capital), producers generally do not hedge a large portion of their production on a long-term basis, seeking, rather, to capture the upside of higher future prices. Speculative traders dealing with financial gas price exposure have the incentive to support price volatility and volume liquidity. Higher volatility has led to higher prices and a volatility penalty for gas-fired generation of electricity when compared to coal-fired generation (±0.65 $/MMBtu in 2004 dollars).

Other analysts go so far as to say that "an in-depth knowledge of fundamentals can be detrimental."[24]

> While not discounting technical charts entirely, Fusaro said traders will have to be attuned to market fundamentals, such as weather and storage levels, to be successful in the new market.
>
> But Tom Saal, of Miami-based Commercial Brokerage, countered that the funds' mere presence in the gas market is proof that chart-following does work because many of them rely exclusively on technicals…
>
> In fact, since hedge funds have gained such a large presence in the futures market, Saal said it is even more important for gas traders to chart market behavior. While acknowledging that fundamentals were pushed aside over the past year in favor of technicals, he said it's the fundamentals that created the recent wave of volatility.
>
> He said while technical charting didn't predict Katrina and the resulting surge in gas futures prices, neither did anyone or anything else." Markets work of fear and greed,@ he argued. "And fear after Katrina that there would be problems this winter with the amount of gas shut-in – it's that fear and greed that created this huge price move."

> Cooper said he is skeptical that traders need more than technical charts to be effective I today's energy markets. "I would have said that, but the way the market has been behaving, I'm not sure. An in-depth knowledge of fundamentals could be detrimental.[25]

While the analysts debate the relative important of fundamental versus technicals, the traders scratch their heads at the behaviors they observe. They see little relationship between the movement of prices and either fundamentals or technicals.

> Meanwhile, spot prices across the Northwest emerged mixed as mild weather across the region reduced power generation loads. Traders in the Rockies reported a quiet morning and appeared puzzled about why cash didn't fall farther. "There is no demand in the [Midcontinent], and utilities are turning gas away along the West Coast – I don=t know who is buying, one Rockies trader said.[26]
>
> In the Northeast, prices fell as much as $1.30 from Wednesday=s midpoints "as loads continue to diminish," a trader in eastern Canada said. "Many traders are starting the [holiday] as well. They just came in, squared up and got out."
>
> While further price erosion could occur today, the trader cautioned that the market might "offer a surprise" and rally. "You could see some short traders buy the market back up since there=s a long weekend coming up and the contrast is closing early."[27]
>
> In the upper Midwest, "trading was all over the place with most points moving with the NYMEX strength early and never giving way," a regional trader said…
>
> Some traders oversold early and had to buy gas back later in the session, which cause most Midcontinent points to strengthen late, a trader reported…
>
> "You have to take a position early, either short or long, without really having to deliver anything," he said. "If you go long early you=ll eventually have to buy back to get back in balance, to get to zeros. They were day-trading the thing."[28]
>
> Some traders attributed the rally to new National Weather Service forecasts calling for below-normal temperatures across much of the country during the second week of February. But others disagreed, citing bullish technical indicators as the primary market driver.
>
> "We don't have any cold weather in the near term and, we're not going to run through our massive storage inventories," an analyst said. Awe've just got a lot of shorts in the market looking to ring in at the cash register."[29]

C. Hype Versus Reality

While some claim that the technical sides of the market should balance out, we have seen that there are forces that may favor upward pressures. Choukas-Bradley and Donelly identify another force – hype.

> Most of the news in the mainstream media will be bullish, all else being equal. This is because bad news makes news, whether it is characterized as corporate profiteering or consumer hardship, and good news for consumers is not interesting enough to be reported. From the consuming public's point of view, bullish price news is bad news. Probably nine out of ten stories in the mass media, all else being equal, will emphasize adverse consequences for average people (e.g., "the coming crisis in natural gas prices"). By contrast, in the producer community such "bad news" is good news, of course. That is, bullish news concerning higher natural gas prices or greater consumer demand is welcome news. This underscores the paradox of the media marketplace in the natural gas industry. The trade press is dominated by the interests of producers, with a bias in favor of higher prices that can support development of incremental supply for growth in consumer demand. The trade press reports and responds to the pronouncements and projections of stock analysts who cover the industry. These individuals write reports about the companies they follow, and they implicitly consider the interest of their industry to reside in higher prices. On the other hand, the mass media pick up pronouncements of high prices as news not because they see it as good news, but for precisely the opposite reason. It is bad news for consumers, and is therefore something worth reporting. Neither the producer-oriented media nor the consumer-oriented media are served institutionally by bearish natural gas price news. Accordingly, bearish news or trends must fight for a place at the media "table," or will not get a seat. Bullish news, on the other hand, will always be given a seat.[30]

Large industrial users reiterate this feeling.

> "The only ones who prosper are finance markets and traders that do not produce, transport, or consume natural gas." [Huntsman] alleged that one of the country's largest financial institutions (which he declined to identify) had touted as "good news" new forecasts of a worse-than-normal hurricane season and the possibility of decreasing gas imports, would be excuses to force up prices. "It makes absolutely no sense."[31]

Traders give these types of explanations when prices seem to be higher than seems justified by either fundamentals or technical factors. "They tried to hype the snow a bit at first, but realistically it's not going to have a very big impact on overall storage draws."[32]

In the Northeast, spot prices gained between 15 cents and 60 cents due to a mixture of “fear, trepidation and greed – but not fundamentals,” according to one eastern Canadian trader.[33]

AYou got a little upward momentum from the tropical storm activity, but it=s probably not causing this much by itself,@ said a Houston-based broker. AThere=s been some short-covering initially that people are concerned about the storm and oft-times that triggers a lot of fund buying, particularly in this price range.

In the cash market, traders also turned their attention to Wilma, which added to an already bullish sentiment. “It’s still a non-event, and the models I’ve seen show it staying away from rigs in the Gulf,” a trader said. “Traders will still talk their position, though, and that’s why we’re seeing some price movement.”[34]

D. Other Sources of Inefficiency

This analysis has focused on the physical and financial markets. The inflexibility of transportation and storage play a key role in creating a vulnerable commodity. There are additional factors at play between the wellhead and the burner tip that undermine the ability of the system to operate efficiently. These deserve consideration as well.

1. Utilities

Institutional factors can play a role as well, by biasing behavior.[35] In natural gas markets, the problem is important because many utilities, who are the purchasing agents for residential ratepayers, do not have a strong incentive to keep costs down, since they are passed through in a monopoly situation. Fearing that regulators might disallow expenses if they play the market, they reduce their own risk by simply tying the cost of acquiring gas to published indexes. Many of the indices are based on voluntary, unaudited reports of traders. Ironically, those reports are based on prices set in transactions in which the utilities themselves never engage.

State regulators have been hesitant to encourage risk-taking behavior by utilities because overseeing such activity is not their expertise and ultimately (residential) consumers are risk averse. Early in the development of natural gas markets, short-term purchases looked better. Now, longer terms would be more prudent, but they are simply not available. Although facilities last for decades and demand is growing slowly, at most, NYMEX’s six-year futures contracts are sparsely traded. Out past a year, markets are thin. Even mid-term contracts are costly and risky, if they can be had at all.

Buyers of natural gas are regulated distribution companies and electric power generators. They are either prohibited from entering natural gas futures

> contracts by their state regulatory commissions or otherwise have dulled incentives to do so. One reason for this conjecture is that they can pass their gas procurement costs to their retail customers through prudence reviews. The second reason is that these regulated companies do not want to be subject to second-guessing by stakeholders. The seasonal pattern of consumption could also be another reason for the observed results.[36]
>
> Theoretically, if a utility buys everything on a spot market, that's sensible from a utilities point of view. They want to avoid the regulatory risk… But it's probably not sensible for their consumers [to bear] all the risk of price volatility for gas and power."[37]

There is a general consensus that utilities are not in the markets as hedgers, although a small number are. Moreover, there is a belief that hedging has declined, as volatility and large financial players have moved into the market.

> "Most utilities have stopped hedging and instead rely on the fuel-adjustment clause that allows them to pass on to consumers… Many utilities exited trading, Duke being the last one. The point is they are not really in the game except for Constellation, Sempra, Dominion and a few others. That more customers are exposed to price risk because they are passing on the higher costs to customers."[38]
>
> Cooper said many utilities probably have stopped hedging in such a risky environment because they have to eat their losses if they miscalculate. "Utilities are not in the business of predicting prices," he said. "They don't care what the price it. They pass it on to customers."[39]

While the institutional context in which utilities function certainly restricts their inclination to play in the financial market, as volatility and prices mount, it becomes more burdensome for all users. The cost of hedging becomes higher and higher.

> But with gas above $10/mmBtu and futures market direction unpredictable, even hedging and other risk management tools are becoming more and more expensive – raising the question of whether the benefit is worth the cost…
>
> For example, Invista uses financial derivatives, collars and similar tools to hedge against current market conditions. But gas at $10/mmbut or higher and unprecedented volatility "makes all of these actions a little more costly," Poole noted. "It raises the question: is the elimination of price volatility worth the cost?"
>
> And while Invista has the money and in-house expertise to handle risk management activities internally rather than farming them out to marketers or

> energy service companies, "unfortunately, for smaller-volume companies that may not be a feasible option."[40]

Tying prices to indices is the ultimate short-term strategy. This institutional view raises concerns because the capital-intensive infrastructure of the industry has historically been financed by long term contracts. The deregulation and unbundling of the industry inevitably shortened the time horizon of the participant. Flexibility and choice loosens commitments and makes "bypass" possible. Pipelines cannot count on shippers as much as in the past. Utilities cannot count on load as much as in the past. Merchants demand faster recovery of costs.

> In fact, a major impetus for restructuring of the natural gas industry was the high social cost associated with rigid long-term contractual arrangements…
>
> With the natural-gas sector restructuring… trading arrangements have become much more short term and flexible in both price and in terms and conditions. We have observed this phenomenon throughout the natural-gas sector, from gas procurement, gas storage, and retail transactions, to capacity contracting for pipeline services.[41]

Long term commitments to transportation and storage facilities, exposes the contracting parties to greater risk in this environment, especially where long term commitments to supply cannot be secured. The mismatch between the incentive structure and the necessary time horizon results in missed opportunities. For example,

> *Jack Flautt,* Managing Director of March & McLean, suggested there is an anomaly in the storage investment area. It is strange, in his view, that investors are not trampling one another to participate in the storage development market. "The value of storage today is greater than at any time in my lifetime," but Flautt reported he gets only blank stares from bankers at the suggestion.[42]

The hesitance of public utility commissions to push utilities to jump back in to long-term commitments is understandable and the task of realigning risks is challenging.[43]

2. Gathering System Market Power

First, with the deregulation of the national markets, oversight over the gathering systems was passed to the states. There is an ongoing dispute over the abuse of market power in these markets. A recent proceeding in Texas provides insight into this issue.

The key issue is the large price wedge that gathering systems can drive between the wellhead price and the Henry Hub price.

> Producers claim that a lack of pipeline competition has hurt their industry, particularly the smaller operators that frequently have access to only a single

> intrastate system and must therefore accept whatever transportation rates the pipeline charges…
>
> "One-sided negotiations over time has become more and more onerous toward producers, and the overwhelming market power of the monopolistic pipelines has reduced the wellhead value of natural gas by over 50% in many cases," said Mills, whose association presents mostly small independent operators. "When Houston ship channel is [$6/MMBtu], the guy out there taking the risk drilling wells and completing wells in a lot of cases is going to get less than $3."[44]

The size of the producers plays a key role. While large players may have sufficient bargaining power to blunt the market power of the pipelines, small players do not.

> Producers large and small asserted that they have been subjected to abusive market practices due to a lack of pipeline competition, while end-users complained of poor gas quality…
>
> David Blakmon, manager of corporate affairs for Houston-based Burlington Resources, said independent producers –which drill 85% of new wells in the state [Texas] – often are forced to enter into that contracts that contain take-it-or-leave-it provision… "Burlington is a big enough company that we make sure we have a market position that allows us to negotiate favorable agreements."
>
> Don Holley, president of Brenham, Texas-based Holley Oil, represented small operators at the workshop. "Three times in the last 18 months I've been presented with a 'take it or shut in your well contract,'" he complained. "We should not be placed in the position of having to take-or-leave contracts."
>
> A new contract negotiated in January increased the transportation cost of his production by 200% per MCF, Holley said, widening the difference between his production at the wellhead and the Henry Hub index price to $4/Mcf.[45]

Beyond the issue of price, the producers face the problem of being unable to find information on rates, terms and conditions.

> The procedure does not provide "the information that the producer needs to access to make a decision" about the actual cost of the gas transportation service the pipeline provides. For example, a producer does not know what rates the pipeline is charging a competitor for the same service.
>
> "They don't know what the actual terms of the cost of service are as a whole… The transparency of information is not existent. We don't know it. They do. It gives them a huge leg up in terms of negotiating the price.[46]

> The intrastate pipelines have attempted "to keep as much information secret and out of producers hands as much as possible." Mills charged. He said the pipelines often use index prices, which are not transparent to smaller producers, as benchmarks for their shipping contracts.
>
> In addition, he said, "the tariffs that the pipelines have to post are all in code. It's virtually impossible to find the price from Point A to point B of a tariff."[47]

E. What it Takes to Move Markets

The discussion of the financial commodity markets has identified the key moments and issues and actors in the physical market. The major petroleum companies have been identified as big players in the financial commodity markets. They have been dinged for trading that breaks the rules in these markets. They are also the dominant firms in the physical market. Thus, they are in unique a position to move the market as traders and speculators in the short term and producers in the long term.

The previous sections provide an account of the history of trading in natural gas. Prior to the Commodity Futures Modernization Act, manipulation of cash settlements was a more theoretical concern because the indices were broad and the positions needed to move them were huge. The CFMA allows narrow indices, which raises concern because the necessary conditions for moving the price are smaller. Other factors that can narrow the necessary position compound the problem. Friction in the physical markets, and illiquidity in the financial markets, makes it easier to move markets.

Factors that facilitate the ability to move the market with smaller positions may play a part as well and are in evidence in the natural gas market. For example, the fact that entities bring huge sums to bear with very sophisticated tools enhances their ability to move the market. Above all, the tightness in a market with very low elasticities magnifies the ability of small changes in supply to move price.

The fact that we have seen actual examples of this price manipulation repeatedly, across all energy commodities, should make it clear that prices can be moved. But the recent reaction to the hurricanes underscores how little it takes.

The loss of production from the hurricanes was quite small. The actual physical loss of production was probably never much greater than 5 percent of national supply at its height, but a substantial part of that loss was offset by demand destruction in the Gulf Coast region. The shortfall in gas for the market was probably in the range of 3 to 5 percent and some estimates of year-over-year comparisons show only a 2 percent reduction. Most analysts agree that even that was partially offset by mild weather and fuel switching.

Even at a 3-5 percent shortfall, the price reaction was extreme. With spot prices supporting a sustained rise of 75 percent, the elasticity would appear to be in the vicinity of

.05. With wellhead prices registering an increase of 50%, that suggests an elasticity of less than 0.1. Stated in traditional terms, a one percent reduction in supply yields a 15 to 20 percent increase in price.

For the obvious reason that the over-the-counter market is unregulated, we do not know how large the positions of the hedge funds are. We would especially like to have this information for key moments, such as during the settlement period. We do have information on the size of the marketers. These would be the entities on the selling side of the market when molecules actually change hands.

BP, the largest marketer prior to Katrina, had a market share of over 20 percent. The next three firms have market shares of about ten percent. Another six firms have market shares in the 3 to 5 percent range. Among these ten firms are four major oil companies and two major utilities. Given the extremely low elasticities of supply and demand and the extremely reactions of the market to relatively small changes in the supply demand balance, careful consideration of the market shares necessary to exercise market power may be in order for the natural gas market.[48]

When entities have ownership of the resources and take large positions in the physical, cash and futures markets, they gain leverage. Purely financial players face a key constraint in long manipulation – the problem of disposing of the excess supply. If you are a trader, who has accumulated a large long position, in time or space, you must dispose of those positions at some point, without driving down prices and erasing your gains.

> Transport costs make it optimal to retain some of the additional units delivered… rather than return them to the market of origin. These additional supplies depress the price. Market slang refers to this as the problem of *burying the body* or *disposing of the corpse*… Intuitively, the manipulator exploits his market power by restricting the number of liquidations in order to elevate the liquidation price. Nonetheless, in order to profit he must liquidate some contracts. If he were to take delivery on his entire position, he would suffer a loss due to the bury-the-body effect. As a result, he takes delivery on only a part of it.[49]

If you are the physical owner of a commodity like natural gas, you do not have to bury the body, you can just leave it in the ground. You do not have to make purchases that later have to be buried. Large producers, flush with cash and not facing competitive market discipline, hold out for an ever-escalating market price. Consumers, in need of physical supplies, pay an increasing premium.

F. Conclusion

The impact of an aberrant market is substantial, producing many of the characteristics that the natural gas market seems to exhibit.

> Precontract-expiration prices vary idiosyncratically with trading volume… reduces market liquidity and depth and increases price volatility…
>
> makes the cash-futures basis excessively variable, thereby reducing the hedge performance of a futures contract…
>
> increase the costs and risks that informed traders incur and reduces the returns to discovering information about fundamental values…
>
> induces these agents to trade less and collect less information…
>
> As a result, the futures price is a less reliable measure of fundamental supply and demand.[50]

Defenders of the financial markets want to blame the whole problem on the physical markets and even claim that traders will help solve the problem by increasing liquidity and sending price signals. But the evidence suggests that the financial commodity market bears at least some of the blame for pushing prices up.

- We have a commodity that is vulnerable to abuse, in a new market that has been under-regulated from its birth.
- Public policy adopted in 2000 further reduced regulation and opened the door to counterproductive, if not outright manipulative, behaviors and pushed prices higher.
- We have a clear theory about how consumers could be hurt in this market.
- Both the structure of the market and the behaviors of market players are biased in favor of higher prices and against consumers.
- We have evidence at the micro levels of a pervasive pattern of past abuses and rumors about suspicious behavior in the current market.

The overall pattern of prices supports the proposition that they have run up beyond anything that is justified by the problems in the physical market. Exhibit I-2 above summarizes the cost v. price analysis presented in previous chapters. A huge wedge has been driven between the costs of production and the futures market prices. The stakes are immense, on the order of $300 billion dollars over the course of half a decade.

ENDNOTES

[1] Robert S. Pyndyck, "Volatility in Natural Gas and Oil Markets," *Journal of Energy and Development,* 30:2004, finds statistically significant increasing volatility in natural gas through mid-2002, but dismisses it as economically insignificant.
[2] Id., p. 3.
[3] The impact of Enron's collapse is complex, with a loss of efficiency (Donald Murray and Zhen Zhu, "EnronOnline and Informational Efficiency in the U.S. Natural Gas Market," *The Energy Journal,* 25: 2004; Pyndyck, "Volatility."
[4] Song Zan, Chiou Wei, and Zhen Zhu, "Commodity Convenience Yield and Risk Premium Determination: The Case of the U.S. Natural Gas Market," *Energy Economics,* forthcoming.
[5] Nahid Movassagh and Bagher Modjtahedi, "Bias and Backwardation in Natural Gas Futures Prices," *The Journal of Futures Markets,* 25: 2005, p. 306.
[6] Bagher Modjtahedi and Nahid Movassagh, "Natural Gas Futures: Bias, Predictive Performance and the Theory of Storage," *Energy Economics,* 27: 2005,p. 635.
[7] Modjtahedi and Movassagh, ""Bias," p. 635.
[8] Id. p. 635. W.K. Bucanon, P. Hodeges and J. Thied, "Which Way the Natural Gas Price: An Attempt to predict the Direction of Natural Gas Spot Price Movements Using Trader Positions," *Energy Economics,* 23: 2001, p. 285, find hedgers short and speculators long.
[9] Indeed, "because of their relatively short time to expiration (1< month in the case of natural gas), first-nearby future prices (sometimes referred to as "prompt-month" or "spot month" prices) are a close approximation of spot prices.
[10] *An Assessment of Prices of Natural Gas Futures Contracts as a Predictor of Realized Spot Prices at the Henry Hub,* p. 6.
[11] *An Assessment of Prices of Natural Gas Futures Contracts as a Predictor of Realized Spot Prices at the Henry Hub,* p. 6.
[12] Platts *Gas Daily,* September 30, 2005, p. 8
[13] Bolinger, Mark and Ryan Wiser, *Comparison of AE O2006* Natural Gas Price Forecast to NYMEX Futures Prices (Ernest Orlando Lawrence Berkeley Laboratory, December 19, 2005).
[14] Bolinger and Wiser, "Comparison," p. 1.
[15] Bolinger, Mark and Ryan Wiser, an William Golove, *Accounting for Fuel Price Risk: Using Forward Natural Gas Prices Instead of Gas Price Forecasts to Compare Renewable to Natural Gas-Fired* (Ernest Orlando Lawrence Berkeley National Laboratory, August 2003), p. vii.
[16] Bolinge and Wiser, "Comparison," p. 1.
[17] EIA, p. 6
[18] Bolinger, Wiser and Golove, "Accounting," p. 42.
[19] Bolinger, Wiser and Golove, "Accounting," p. 44.
[20] Bolinger, Wiser and Golove, "Accounting," pp. 44-45.
[21] Platts *Gas Daily,* February 13, p. 6.
[22] Platts *Gas Daily,* Feb. 7, 2006, p. 7.
[23] Foster Report, No. 2544, June 9, 2005, p. 21
[24] Platts *Gas Daily,* January 3, 2006, p. 4.
[25] Platts *Gas Daily,* January 3, 2006, p. 4.
[26] Platts *Gas Daily,* Sept. 13, 2005, p. 2.
[27] Platts *Gas Daily,* December 23, 2005, p. 2.
[28] Platts *Gas Daily,* Jan. 30, 2006, p. 2.
[29] Platts *Gas Daily,* Jan. 31, 2006, p. 2.
[30] Choukas-Bradley and Donnelly, pp. 2-3.
[31] Foster Report, No. 2544, June 9, 2005, p. 21
[32] Platts *Gas Daily,* Feb. 14, 2005,p. 2.
[33] Platts *Gas Daily,* Aug. 31, 2005, p.2.

[34] Platts *Gas Daily,* October 18, 2005.
[35] Pirrong uses pension and mutual funds as an example. "They are unable to trade certain types of instruments, which are lower cost ways of liquidating contracts. "The incur transaction costs to do so. Moreover, the funds tend to follow *buy and hold* strategies… in order to meet cash flow management objectives. This suggests that they incur high explicit or implicit costs to trade their portfolios."
[36] Movassagh and Modjtahedi, 2005, p. 306.
[37] Platts, *Gas Daily,* Jan 4, 2006, p. 4.
[38] Platts *Gas Daily,* January 3, 2006, p. 4
[39] Platts *Gas Daily,* January 3, 2006, p. 4.
[40] Platts, *Gas Daily,* September 12, 2005, p. 1Y 4.
[41] Costello, Ken, "Are Regulators in for the Long Haul?," *Public Utilities Fortnightly,* July, 2005, p. 48.
[42] *Foster Report No. 2576,* January 27, 2006, p. 16.
[43] Several recent studies point to a complex package of policies need to accomplish this (see for example, INGAA foundation, Inc., *Discussion of Effects of Long-Term Gas Commodity Contracts on the Development of North American Natural Gas Infrastructure,* prepared by Energy and Environment Analysis, Inc., 2005) and recognize that case-by-case decisions based on fact intensive analysis is needed, rather sweeping recommendations are inappropriate (see for example, NARUC/IOGCC Joint Task Force, *Policy Recommendations for Long-Term Contracting for Natural Gas Transportation, Storage Services and Liquified Natural Gas Deliver,* October 2005.
[44] Platts *Gas Daily,* November 28, 2005, p. 5.
[45] Platts *Gas Daily,* December 7, 2005, p. 4.
[46] Platts *Gas Daily,* November 29, 2005, p. 4.
[47] Platts *Gas Daily,* November 28, 2005, p. 5.
[48] This debate is taking place with respect to the oil industry (see Cooper, Mark, *Record Prices, Record Oil Company Profits: The Failure Of Antitrust Enforcement To Protect American Energy Consumers,* Antitrust Section, American Bar Association, April 1, 2005) and electricity ("Recognizing the Limits of Markets, Rediscovering Public Interest in Utilities," in Robert E. Willett (ed), Electric and Natural Gas Business: Understanding It! (2003 and Beyond) (Houston: Financial Communications: 2003), as well as natural gas ("Too Much Deregulation or Not Enough," *Natural Gas and Electricity*, June 2005; "Real Energy Crisis is $200 Billion Natural Gas Price Increase," Natural Gas and Electricity, August 2004).
[49] Pirrong, 33… 34
[50] Pirrong, p. 12

V. POLICY OPTIONS

In our view, the obvious implication of the foregoing analysis is that these markets should be subject to close observation and oversight. Unfortunately, they have been treated in the opposite manner, exempt from scrutiny. Instead of more oversight, they have been subject to less. Policymakers in Washington, who have primary responsibility for this interstate market, have failed to do much about the run up in prices. In fact, over the years they have done a number of things to make matters worse. In the face of the Enron-led trading scandals, their reaction seems to have been to rush to let more traders do more things in unregulated financial markets.

There has been a failure of public policy at every level to build a system that protects the public. The structure of the physical markets induces conduct that has created and is sustaining a tight market. The structure of the financial commodities markets induces conduct that magnifies upward pressures on prices. To say that there is more than enough blame to go around is an understatement. It may well be that the physical markets and financial markets are equally at fault and that institutional structures and conduct in each of the markets share the blame. If the physical market were not so tight, things would not be as bad as they are in the financial commodity markets, but that is not to say they would be good. If the financial markets worked better, prices would not spiral so forcefully, but there still would be upward pressures emanating from the physical market. Reforming one set of markets without addressing the other may leave consumers inadequately protected.

A. Recent Studies of Natural Gas Financial Markets

The Federal Energy Regulatory Commission[1] and the Commodity futures Trading Commission[2] have both issued reports in the past few weeks that conclude that there has been no market manipulation, while the Government Accountability Office is reserving judgment.[3] These studies have no laid the concerns to rest for a number of reasons.

Studies by the CFTC and the Government Accountability Office "can't assure the public that the over-the-counter market isn't being manipulated."[4] Even where the trading is regulated and regulators have taken a peak at what is going on, questions persist. "Studies by the New York Mercantile Exchange and the Commodity Futures Trading Commission have disputed the notion that hedge funds are having undue influence on pricing or volatility… [M]any traders scoffed at the studies, saying that they focused only on certain months, missing price run-ups."[5]

- The studies do not deal with a period in which there was a rapid run up in prices. It does appear that if you study the wrong months in the wrong markets, you will not learn very much.[6]

- The Commission does not have the data necessary to uncover many of the effects that are a concern.

- Blatant manipulation is not the only issue; the concern is a much broader range of behaviors and structural effects.

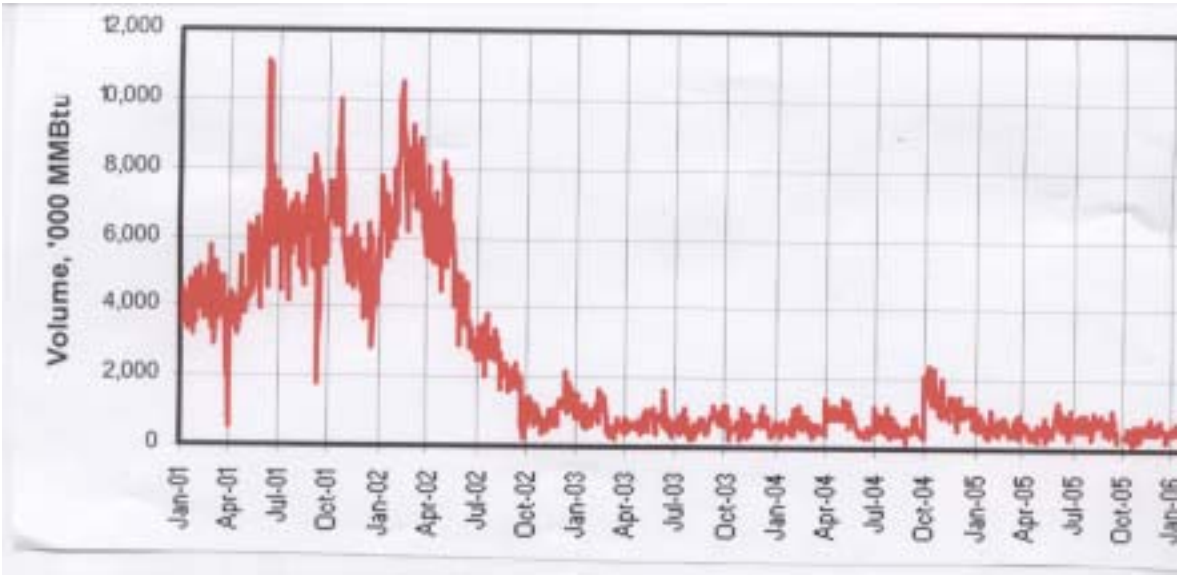
- The claim that the market is efficient is refuted by the detailed academic studies. The opinion about the efficiency of the natural gas market varies across time.[7]

- The assertion that the market provides liquidity and price discovery is in dispute. Out beyond a couple of months there is very little liquidity on the exchanges subject to CFTC jurisdiction.

Efforts to ensure the accuracy of prices in the over-the-counter market have been equally unsatisfying. The indices on which many contracts rely are privately compiled reports of transactions. This reporting was entirely voluntary and unaudited. Misreporting was uncovered and the Federal Energy Regulatory Commission considered reform. It chose to suggest a code of conduct. Reporting remains voluntary and unaudited. Those reporting must merely attest to the veracity of the reported transactions they choose to report.

When the spotlight was first turned on the construction of the survey, many firms ceased reporting their transactions. Now that the process has been reformed, the amount of reporting remains extremely low (see Exhibit V-1). The quantity of reported transactions are

EXHIBIT III-4: GAS DAILY HENRY HUB VOLUME



Source: Gas Daily.

an extremely small fraction of the total gas consumed in the country – one to two percent. While there are other indices and one need not assume that gas should be transacted in this cash market to be consumed, the fact that such a small quantity of gas plays such an important role in price setting is a concern. This is particularly the case where the reported transactions are self-selected. A recent study by the Government Accountability Office gave the reporting system a grade of C (70 percent), with a substantial minority continuing to express concern about the functioning of the reporting system.

B. Recent Changes in Natural Gas Financial Market Oversight

The FERC has also issued rules implementing the Energy Policy Act of 2005 that change its market monitoring procedures and implement new powers granted in the Act.[8] It has entered into a vague memorandum of understanding about sharing information.[9] The foregoing analysis demonstrates that a lot more than manipulation is at issue in the natural gas price spiral and suggests that much more needs to be done. Both the FERC and the CFTC are looking for a very narrow range of manipulative behaviors with a very narrow telescope. Unlike other physical commodities, a vast amount of trading of natural gas goes on in the over-the-counter markets that are hidden from the view and beyond the authority of these agencies. The indices that are based on this unregulated market activity have been unreliable and remain subject to doubt.

In the case of regulated activities the changes at the FERC replicate the weaknesses of the CFTC approach by adopting its definitions and case law. It may be illegal to contrive to manipulate markets and there are new fines if you are caught doing so, but the FERC is going to have great difficulty proving manipulation, when prices are "moved." It is precisely for this reason that the CFTC and the exchanges subject to its jurisdiction do more than rely on narrowly defined manipulation statutes to prevent abuse.

As noted above exchanges adopt additional measures to limit the ability to move prices – like position limits and price change limits. Unfortunately, for natural gas, these remain far too lax. FERC has no authority to implement effective trading limits and the CFTC has chosen not to do so.

Reform of natural gas trading has become a focal point of debate in legislation to reauthorize the Commodity Futures Trading Commission. The traders are resisting any new oversight or authority. A weak set of reforms was passed in the House, while the Senate continues to debate the issue. The foregoing analysis suggests that the original proposals introduced in the House are what it needed to protect the public from wildly gyrating natural gas prices.

In the financial markets, speculators have been quick to seize the opportunity to push prices up. The structure of the market gives them ample opportunity to do so. The financial markets compound the problem because they are structured in such a way that a large number

of small buyers who have weakened incentives and limited ability to resist price increases face a small number of large sellers who have a strong incentive and a much greater ability to hold out for higher prices. Holding out in the supply side may simply mean buying and holding assets in the ground or positions in the futures market and waiting for buyers who need the commodity to blink.

Most troubling is the fact that many of the impacts of many of the legislative and regulatory policies that have worked to the detriment of consumers were predictable and preventable, given the nature of the commodity and the type of market that Congress and the regulatory agencies in Washington created. After a half dozen years of turmoil in natural gas markets, we still have a lot more questions than answers.

Unlike bankers and brokers in organized markets, traders in the over-the-counter market do not have to register or demonstrate their competence or good character. They do not have to report their holdings or positions in markets. They can buy and sell this vital commodity with little capital or collateral to back up their promises. In organized exchanges, where traders do have to register, report and show financial and managerial competence, the rules are too lax. The holdings a large player can amass are huge. The period in which prices are set is short. Selected players have preferential access to important parts of the market.

Market rules should discourage unproductive trading and be particularly on guard at moments of vulnerability. This can be accomplished by establishing reasonable limits on positions and ensuring that settlement periods are liquid and long. Vigorous oversight and stiff punishment of manipulation should be meted out swiftly. These steps are so basic and obvious it is hard to understand why they have not been implemented, but they have not.

C. Oversight of the Unregulated Over-the-Counter Markets is Needed

Doing nothing is not an option. At a minimum the public deserves an intensive examination of every aspect of the natural gas market. Such an examination would suggest that more authority be vested in responsible institutions because the vast majority of natural gas transactions are beyond regulatory jurisdiction.

Such an examination should not be a one-time undertaking. The stakes are simply too high in the natural gas market. The instances of “wacky” behavior are too frequent to ignore—the market must be subject to scrutiny. Ongoing scrutiny would require that traders in all natural gas markets register and report. Traders should be competent, honest people. They should be required to register, like bankers do. They should have the resources to meet their commitments and stand behind their trades, as bankers are required to. Regulators should be able to see all markets so they can detect efforts to move any individual market, which means large transactions and positions should be reported.

If we go back to the ways the market can be gamed, legally and illegally, to the detriment of consumers, policy solutions immediately present themselves. Above all,

oversight should apply to all markets. The opaqueness created by the presence of completely unregulated traders should be eliminated.

The claim that the cost of registering and reporting would be unduly burdensome[10] fail to take account of the huge burden that natural gas prices have placed on consumers and the huge flow of profits that could be (1) used by the companies to comply and (2) provide a base for fees to fund the necessary studies. Indeed, what you end up doing, purposeful or otherwise, is misleading decision makers.

D. Basic Consumer Protections for Natural Gas Trading

Simply monitoring activities may not be sufficient to ensure that natural gas markets operate efficiently and equitably. The nature of the underlying commodity is such that it is especially vulnerable. Policies can be structured to avoid trading abuses. The objective is to diminish the ability to move the market at key moments.

Position limits make it difficult to control a sufficient quantity of the commodity to influence the price. Lengthening the settlement period, to which many contracts are indexed, ensures that more transactions will be included in setting the price that consumers pay. Preferential access to trading markets should not be allowed, as this gives an advantage to speculators.

Trading breaks are another approach to dampening volatility. These include limitations on the magnitude of price changes or shutting down trading during emergencies. It is remarkable that, on a percentage basis, natural gas prices are allowed larger swings than many other commodities that have much less troubling characteristics.

The repeated pattern of abuse in these markets makes it clear that past actions have been inadequate to eliminate anti-consumer behaviors. Clearer definitions of unacceptable behavior are needed with stiffer penalties for abuse. By subjecting all markets to oversight and registration, the ability of abusers to migrate from regulated to unregulated markets will be eliminated.

E. State Regulatory Issues

The role of state policy in these aspects of the industry is limited. State policy deals with the end-user markets, the local distribution utilities. It is difficult to change the system from the buying end, where the primary constraint is to make sure consumers have gas to heat their homes. States could force the above reforms by requiring their utilities to deal only with traders who are subject to oversight – who register, report and are audited.

States can also encourage utilities to be more aggressive in holding costs down, but the challenge is to find approaches that do so without exposing consumers to excessive risk.

F. Physical Market Issues

In the physical market, policymakers have allowed the supply side to become concentrated and vulnerable to the exercise of market power. Meanwhile, producers have been slow to invest in exploration and development, compounding the problem of tight supplies.

The Federal Energy Regulatory Commission exacerbated the problem by failing to ensure a transparent price reporting mechanism. It deregulated markets and granted market–based rate authority without requiring full and honest disclosure of information or effective competition on the ground. In retrospect, it appears that there have been repeated market "aberrations," but fraud and market manipulation are not the only concerns. The ability of strategic behavior to influence price because of structural weaknesses in market rules is a more general concern.

The position of the major oil companies with large holdings of natural gas physical assets, dominance of natural gas marketing, and active involvement in natural gas financial markets poses a serious threat to consumers. The inadequate investment in exploration over the course of a decade or more contributed to the tight supply conditions. The massive windfall of cash flow in recent years dulls the incentive for the majors to supply gas to the market. They can keep it in the ground and hold out for higher prices. They are under no pressure to sign long-term contracts, except at extremely high prices. As major marketers and traders, they can move markets.

The fact that the majors straddle these markets, several of which are lightly or unregulated, compounds the problem, since their ability to profit by taking contrary positions in various markets is hidden from regulators. Policymakers must have the information necessary to make informed judgments about whether the major oil companies are exercising market power, strategically in the long-term and unfairly exploiting the tight markets they have helped to create in the short term.

A joint task force of federal and state anti-trust and regulatory authorities should be formed to examine:

(1) the regional concentration of natural gas supplies because the nation is not a single market and national concentration ratios are misleading;

(2) the behavior of the majors as marketers;

(3) actions of the major oil companies across all of the markets in which they are involved B physical as marketers, over-the-counter and in exchanges as traders.

ENDNOTES

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[4] Barrionuevo, "Energy Trading," p. 3-3.
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[8] Federal Energy Regulatory Commission, Order No. 670, Prohibition of Energy Market Manipulation, Docket No. RM06-3-000, January 19, 2006.
[9] Memorandum of Understanding Between The Feeralenergy Regulatory Commission and the Commodity Futures Tradigin Commission Regarding Iformatoi Sharing and Treatment of Proprietary Trading and Other Information, October 12, 2005.
[10] *Address of Sharon Brown-Hruska,* UBS Global Oil and Gas Conference, June 3, 2004.

GLOSSARY

(Source: Commodity Futures Trading Commission and the Energy Information Administration)

Actuals: The physical or cash commodity, as distinguished from a futures contract. See Cash and Spot Commodity.

Allowances: The discounts (premiums) allowed for grades or locations of a commodity lower (higher) than the par (or basis) grade or location specified in the futures contract. See Differentials.

Approved Delivery Facility: Any bank, stockyard, mill, storehouse, plant, elevator, or other depository that is authorized by an exchange for the delivery of commodities tendered on futures contracts.

Arbitrage: A strategy involving the simultaneous purchase and sale of identical or equivalent commodity futures contracts or other instruments across two or more markets in order to benefit from a discrepancy in their price relationship. In a theoretical efficient market, there is a lack of opportunity for profitable arbitrage. See Spread.

Artificial Price: A futures price that has been affected by a manipulation and is thus higher or lower than it would have been if it reflected the forces of supply and demand.

Back Months: Futures delivery months other than the spot or front month (also called deferred months).

Backwardation:Market situation in which futures prices are progressively lower in the distant delivery months. For instance, if the gold quotation for January is $360.00 per ounce and that for June is $355.00 per ounce, the backwardation for five months against January is $5.00 per ounce. (Backwardation is the opposite of contango). See Inverted Market.

Barrel: A unit of volume equal to 42 U.S. gallons.

Basis:The difference between the spot or cash price of a commodity and the price of the nearest futures contract for the same or a related commodity. Basis is usually computed in relation to the futures contract next to expire and may reflect different time periods, product forms, grades , or locations.

Basis Grade: The grade of a commodity used as the standard or par grade of a futures contract.

Basis Point: The measurement of a change in the yield of a debt security. One basis point equals 1/100 of one percent.

Basis Quote: Offer or sale of a cash commodity in terms of the difference above or below a futures price (e.g., 10 cents over December corn).

Basis Risk: The risk associated with an unexpected widening or narrowing of basis between the time a hedge position is established and the time that it is lifted.

Basis Swap: A swap whose cash settlement price is calculated based on the basis between a futures contract and the spot price of the underlying commodity or a closely related commodity on a specified date.

bbl: The abbreviation for barrel(s).

bbl/d: The abbreviation for barrel(s) per day.

bbl/sd: The abbreviation for barrel(s) per stream day

bcf: The abbreviation for billion cubic feet.

Bear:One who expects a decline in prices. The opposite of a bull. A news item is considered bearish if it is expected to result in lower prices.

Bear Market: A market in which prices generally are declining over a period of months or years. Opposite of Bull Market.

Bear Market Rally: A temporary rise in prices during a bear market. See Correction.

Beta (Beta Coefficient): A measure of the variability of rate of return or value of a stock or portfolio compared to that of the overall market, typically used as a measure of riskiness.

Bid:An offer to buy a specific quantity of a commodity at a stated price.

Break:A rapid and sharp price decline.

Broad-Based Security Index: Any index of securities that does not meet the legal definition of Narrow-Based Security Index.

Broker:A person paid a fee or commission for executing buy or sell orders for a customer. In commodity futures trading, the term may refer to: (1) Floor Broker — a person who actually executes orders on the trading floor of an exchange; (2) Account Executive or Associated Person — the person who deals with customers in the offices of Futures Commission Merchants; or (3) the Futures Commission Merchant.

British thermal unit: The quantity of heat required to raise the temperature of 1 pound of liquid water by 1 degree Fahrenheit at the temperature at which water has its greatest density (approximately 39 degrees Fahrenheit).

Btu: The abbreviation for British thermal unit(s).

Btu conversion factors: Btu conversion factors for site energy are as follows:
Electricity ..... 3,412 Btu/kilowatthour
Natural Gas ..... 1,031 Btu/cubic foot
Fuel Oil No.1 ..... 135,000 Btu/gallon
Kerosene ..... 135,000 Btu/gallon
Fuel Oil No.2 ..... 138,690 Btu/gallon
LPG (Propane) ..... 91,330 Btu/gallon
Wood ..... 20 million Btu/cord

Btu per cubic foot: The total heating value, expressed in Btu, produced by the combustion, at constant pressure, of the amount of the gas that would occupy a volume of 1 cubic foot at a temperature of 60 degrees F if saturated with water vapor and under a pressure equivalent to that of 30 inches of mercury at 32 degrees F and under standard gravitational force (980.665 cm. per sec. squared) with air of the same temperature and pressure as the gas, when the products of combustion are cooled to the initial temperature of gas and air when the water formed by combustion is condensed to the liquid state. (Sometimes called gross heating value or total heating value.)

Bucketing:Directly or indirectly taking the opposite side of a customer's order into a broker's own account or into an account in which a broker has an interest, without open and competitive execution of the order on an exchange. Also called "trading against."

Bucket Shop: A brokerage enterprise that "books" (i.e., takes the opposite side of) retail customer orders without actually having them executed on an exchange.

Bull:One who expects a rise in prices. The opposite of bear. A news item is considered bullish if it is expected to result in higher prices.

Bull Market: A market in which prices generally are rising over a period of months or years. Opposite of Bear Market.

Buyer:A market participant who takes a long futures position or buys an option. An option buyer is also called a taker, holder, or owner.

Buyer's Call: A purchase of a specified quantity of a specific grade of a commodity at a fixed number of points above or below a specified delivery month futures price with the buyer allowed a period of time to fix the price either by purchasing a futures contract for the account of the seller or telling the seller when he wishes to fix the price. See Seller's Call.

Buying Hedge (or Long Hedge): Hedging transaction in which futures contracts are bought to protect against possible increases in the cost of commodities. See Hedging.

Call: (1) An option contract giving the buyer the right but not the obligation to purchase a commodity or other asset or to enter into a long futures position; (2) a period at the opening and the close of some futures markets in which the price for each futures contract is established by auction; or (3) the requirement that a financial instrument be returned to the issuer prior to maturity, with principal and accrued interest paid off upon return. See Buyer's Call, Seller's Call.

Carrying Charges: Cost of storing a physical commodity or holding a financial instrument over a period of time. These charges include insurance, storage, and interest on the deposited funds, as well as other incidental costs. It is a carrying charge market when there are higher futures prices for each successive contract maturity. If the carrying charge is adequate to reimburse the holder, it is called a "full charge." See Negative Carry, Positive Carry, and Contango.

Cash Commodity: The physical or actual commodity as distinguished from the futures contract, sometimes called Spot Commodity or Actuals.

Cash Forward Sale: See Forward Contract.

Cash Market: The market for the cash commodity (as contrasted to a futures contract) taking the form of: (1) an organized, self-regulated central market (e.g., a commodity exchange); (2) a decentralized over-the-counter market; or (3) a local organization, such as a grain elevator or meat processor, which provides a market for a small region.

Cash Price: The price in the marketplace for actual cash or spot commodities to be delivered via customary market channels.

Cash Settlement: A method of settling certain futures or option contracts whereby the seller (or short) pays the buyer (or long) the cash value of the commodity traded according to a procedure specified in the contract. Also called Financial Settlement, especially in energy derivatives.

CEA: Commodity Exchange Act or Commodity Exchange Authority.

CFTC: See Commodity Futures Trading Commission.

Churning: Excessive trading of a discretionary account by a person with control over the account for the purpose of generating commissions while disregarding the interests of the customer.

Circuit Breakers: A system of coordinated trading halts and/or price limits on equity markets and equity derivative markets designed to provide a cooling-off period during large, intraday market declines. The first known use of the term circuit breaker in this context was in the Report of the Presidential Task Force on Market Mechanisms (January 1988), which recommended that circuit breakers be adopted following the market break of October 1987.

Citygate: A point or measuring station at which a distributing gas utility receives gas from a natural gas pipeline company or transmission system.

Clearing: The procedure through which the clearing organization becomes the buyer to each seller of a futures contract or other derivative, and the seller to each buyer for clearing members.

Close: The exchange-designated period at the end of the trading session during which all transactions are considered made "at the close." See Call.

Closing-Out: Liquidating an existing long or short futures or option position with an equal and opposite transaction. Also known as Offset.

Closing Price (or Range): The price (or price range) recorded during trading that takes place in the final period of a trading session's activity that is officially designated as the "close."

Commercial: An entity involved in the production, processing, or merchandising of a commodity.

Commitments: See Open Interest.

Commodity: A commodity, as defined in the Commodity Exchange Act, includes the agricultural commodities enumerated in Section 1a(4) of the Commodity Exchange Act and all other goods and articles, except onions as provided in Public Law 85-839 (7 U.S.C. § 13-1), a 1958 law that banned futures trading in onions, and all services, rights, and interests in which contracts for future delivery are presently or in the future dealt in.

Commodity Exchange Act: The Commodity Exchange Act, 7 U.S.C. § 1, et seq., provides for the federal regulation of commodity futures and options trading. See Commodity Futures Modernization Act.

Commodity Exchange Commission: A commission consisting of the Secretary of Agriculture, Secretary of Commerce, and the Attorney General, responsible for administering the Commodity Exchange Act prior to 1975.

Commodity Futures Modernization Act: The Commodity Futures Modernization Act of 2000 (CFMA), Pub. L. No. 106-554, 114 Stat. 2763, reauthorized the Commodity Futures Trading Commission for five years and overhauled the Commodity Exchange Act to create a flexible structure for the regulation of futures and options trading. Significantly, the CFMA codified an agreement between the CFTC and the Securities and Exchange Commission to repeal the 18-year-old ban on the trading of single stock futures.

Commodity Futures Trading Commission (CFTC): The Federal regulatory agency established by the Commodity Futures Trading Act of 1974 to administer the Commodity Exchange Act.

Commodity Option: An option on a commodity or a futures contract.

Congestion: (1) A market situation in which shorts attempting to cover their positions are unable to find an adequate supply of contracts provided by longs willing to liquidate or by new sellers willing to enter the market, except at sharply higher prices (see Squeeze, Corner); (2) in technical analysis, a period of time characterized by repetitious and limited price fluctuations.

Contango: Market situation in which prices in succeeding delivery months are progressively higher than in the nearest delivery month; the opposite of backwardation.

Contract: (1) A term of reference describing a unit of trading for a commodity future or option; (2) an agreement to buy or sell a specified commodity, detailing the amount and grade of the product and the date on which the contract will mature and become deliverable.

Contract Grades: Those grades of a commodity that have been officially approved by an exchange as deliverable in settlement of a futures contract.

Contract Market: A board of trade or exchange designated by the Commodity Futures Trading Commission to trade futures or options under the Commodity Exchange Act. A contract market can allow both institutional and retail participants and can list for trading futures contracts on any commodity, provided that each contract is not readily susceptible to manipulation. Also called Designated Contract Market. See Derivatives Transaction Execution Facility.

Contract Month: See Delivery Month.

Contract Size: The actual amount of a commodity represented in a contract.

Contract Unit: See Contract Size.

Corner: (1) Securing such relative control of a commodity that its price can be manipulated, that is, can be controlled by the creator of the corner; or (2) in the extreme situation, obtaining contracts requiring the delivery of more commodities than are available for delivery. See Squeeze, Congestion.

Correction: A temporary decline in prices during a bull market that partially reverses the previous rally. See Bear Market Rally.

Counterparty: The opposite party in a bilateral agreement, contract, or transaction. In the retail foreign exchange (or forex) context, the party to which a retail customer sends its funds; lawfully, the party must be one of those listed in Section 2(c)(2)(B)(ii)(I)-(VI) of the Commodity Exchange Act.

Counterparty Risk: The risk associated with the financial stability of the party entered into contract with. Forward contracts impose upon each party the risk that the counterparty will default, but futures contracts executed on a designated contract market are guaranteed against default by the clearing organization.

Counter-Trend Trading: In technical analysis, the method by which a trader takes a position contrary to the current market direction in anticipation of a change in that direction.

Cover: (1) Purchasing futures to offset a short position (same as Short Covering); see Offset, Liquidation ; (2) to have in hand the physical commodity when a short futures sale is made, or to acquire the commodity that might be deliverable on a short sale.

Cross-Hedge: Hedging a cash market position in a futures or option contract for a different but price-related commodity.

Daily Price Limit: The maximum price advance or decline from the previous day's settlement price permitted during one trading session, as fixed by the rules of an exchange.

Day Ahead: See Next Day.

Day Trader: A trader, often a person with exchange trading privileges, who takes positions and then offsets them during the same trading session prior to the close of trading.

Dealer: An individual or firm that acts as a market maker in an instrument such as a security or foreign currency.

Delivery: The tender and receipt of the actual commodity, the cash value of the commodity, or of a delivery instrument covering the commodity (e.g., warehouse receipts or shipping certificates), used to settle a futures contract. See Notice of Delivery, Delivery Notice.

Delivery, Current: Deliveries being made during a present month. Sometimes current delivery is

Derivative: A financial instrument, traded on or off an exchange, the price of which is directly dependent upon (i.e., "derived from") the value of one or more underlying securities, equity indices, debt instruments, commodities, other derivative instruments, or any agreed upon pricing index or arrangement (e.g., the movement over time of the Consumer Price Index or freight rates). Derivatives involve the trading of rights or obligations based on the underlying product, but do not directly transfer property. They are used to hedge risk or to exchange a floating rate of return for fixed rate of return. Derivatives include futures, options, and swaps. For example, futures contracts are derivatives

Diesel fuel: A fuel composed of distillates obtained in petroleum refining operation or blends of such distillates with residual oil used in motor vehicles. The boiling point and specific gravity are higher for diesel fuels than for gasoline.

Directional (deviated) well: A well purposely deviated from the vertical, using controlled angles to reach an objective location other than directly below the surface location. A directional well may be the original hole or a directional "sidetrack" hole that deviates from the original bore at some point below the surface. The new footage associated with directional "sidetrack" holes should not be confused with footage resulting from remedial sidetrack drilling. If there is a common bore from which two or more wells are drilled, the

first complete bore from the surface to the original objective is classified and reported as a well drilled. Each of the deviations from the common bore is reported as a separate well.

Discount: (1) The amount a price would be reduced to purchase a commodity of lesser grade; (2) sometimes used to refer to the price differences between futures of different delivery months, as in the phrase "July at a discount to May," indicating that the price for the July futures is lower than that of May.

Distillate fuel oil: A general classification for one of the petroleum fractions produced in conventional distillation operations. It includes diesel fuels and fuel oils. Products known as No. 1, No. 2, and No. 4 diesel fuel are used in on-highway diesel engines, such as those in trucks and automobiles, as well as off-highway engines, such as those in railroad locomotives and agricultural machinery. Products known as No. 1, No. 2, and No. 4 fuel oils are used primarily for space heating and electric power generation.

No. 1 Distillate: A light petroleum distillate that can be used as either a diesel fuel (see No. 1 Diesel Fuel) or a fuel oil. See No. 1 Fuel Oil.

No. 1 Diesel Fuel: A light distillate fuel oil that has distillation temperatures of 550 degrees Fahrenheit at the 90-percent point and meets the specifications defined in ASTM Specification D 975. It is used in high-speed diesel engines, such as those in city buses and similar vehicles. See No. 1 Distillate above.

No. 1 Fuel Oil: A light distillate fuel oil that has distillation temperatures of 400 degrees Fahrenheit at the 10-percent recovery point and 550 degrees Fahrenheit at the 90-percent point and meets the specifications defined in ASTM Specification D 396. It is used primarily as fuel for portable outdoor stoves and portable outdoor heaters. See No. 1 Distillate above.

No. 2 Distillate: A petroleum distillate that can be used as either a diesel fuel (see No. 2 Diesel Fuel definition below) or a fuel oil. See No. 2 Fuel oil below.

No. 2 Diesel Fuel: A fuel that has distillation temperatures of 500 degrees Fahrenheit at the 10-percent recovery point and 640 degrees Fahrenheit at the 90-percent recovery point and meets the specifications defined in ASTM Specification D 975. It is used in high-speed diesel engines, such as those in railroad locomotives, trucks, and automobiles. See No. 2 Distillate above.

Low Sulfur No. 2 Diesel Fuel: No. 2 diesel fuel that has a sulfur level no higher than 0.05 percent by weight. It is used primarily in motor vehicle diesel engines for on-highway use.

High Sulfur No. 2 Diesel Fuel: No. 2 diesel fuel that has a sulfur level above 0.05 percent by weight.

No. 2 Fuel oil (Heating Oil): A distillate fuel oil that has distillation temperatures of 400 degrees Fahrenheit at the 10-percent recovery point and 640 degrees Fahrenheit at the 90-percent recovery point and meets the specifications defined in ASTM Specification D 396. It is used in atomizing type burners for domestic heating or for moderate capacity commercial/industrial burner units. See No. 2 Distillate above.

No. 4 Fuel: A distillate fuel oil made by blending distillate fuel oil and residual fuel oil stocks. It conforms with ASTM Specification D 396 or Federal Specification VV-F-815C and is used extensively in industrial plants and in commercial burner installations that are not equipped with preheating facilities. It also includes No. 4 diesel fuel used for low- and medium-speed diesel engines and conforms to ASTM Specification D 975.

No. 4 Diesel Fuel and No. 4 Fuel Oil: See No. 4 Fuel above.

Dry natural gas: Natural gas which remains after: 1) the liquefiable hydrocarbon portion has been removed from the gas stream (i.e., gas after lease, field, and/or plant separation); and 2) any volumes of nonhydrocarbon gases have been removed where they occur in sufficient quantity to render the gas unmarketable. Note: Dry natural gas is also known as consumer-grade natural gas. The parameters for measurement are cubic feet at 60 degrees Fahrenheit and 14.73 pounds per square inch absolute. Also see **Natural gas**.

Dry natural gas production: The process of producing consumer-grade natural gas. Natural gas withdrawn from reservoirs is reduced by volumes used at the production (lease) site and by processing losses. Volumes used

at the production site include (1) the volume returned to reservoirs in cycling, repressuring of oil reservoirs, and conservation operations; and (2) gas vented and flared. Processing losses include (1) nonhydrocarbon gases (e.g., water vapor, carbon dioxide, helium, hydrogen sulfide, and nitrogen) removed from the gas stream; and (2) gas converted to liquid form, such as lease condensate and plant liquids. Volumes of dry gas withdrawn from gas storage reservoirs are not considered part of production. Dry natural gas production equals marketed production less extraction loss.

Economically Deliverable Supply: That portion of the deliverable supply of a commodity that is in position for delivery against a futures contract, and is not otherwise unavailable for delivery. For example, Treasury bonds held by long-term investment funds are not considered part of the economically deliverable supply of a Treasury bond futures contract.

Efficient Market: In economic theory, an efficient market is one in which market prices adjust rapidly to reflect new information. The degree to which the market is efficient depends on the quality of information reflected in market prices. In an efficient market, profitable arbitrage opportunities do not exist and traders cannot expect to consistently outperform the market unless they have lower-cost access to information that is reflected in market prices or unless they have access to information before it is reflected in market prices. See Random Walk.

Electronic Trading Facility: A trading facility that operates by an electronic or telecommunications network instead of a trading floor and maintains an automated audit trail of transactions.

Emergency: Any market occurrence or circumstance which requires immediate action and threatens or may threaten such things as the fair and orderly trading in, or the liquidation of, or delivery pursuant to, any contracts on a contract market.

EIA: The Energy Information Administration. An independent agency within the U.S. Department of Energy that develops surveys, collects energy data, and analyzes and models energy issues. The Agency must meet the requests of Congress, other elements within the Department of Energy, Federal Energy Regulatory Commission, the Executive Branch, its own independent needs, and assist the general public, or other interest groups, without taking a policy position. See more information about EIA at **http://www.eia.doe.gov/neic/aboutEIA/aboutus.htm**

End user: A firm or individual that purchases products for its own consumption and not for resale (i.e., an ultimate consumer).

Equity: As used on a trading account statement, refers to the residual dollar value of a futures or option trading account, assuming it was liquidated at current prices.

Exchange: A central marketplace with established rules and regulations where buyers and sellers meet to trade futures and options contracts or securities. Exchanges include designated contract markets and derivatives transaction execution facilities.

FERC: The Federal Energy Regulatory Commission.

Fictitious Trading: Wash trading, bucketing, cross trading, or other schemes which give the appearance of trading but actually no bona fide, competitive trade has occurred.

Final Settlement Price: The price at which a cash-settled futures contract is settled at maturity, pursuant to a procedure specified by the exchange.

Financial Instruments: As used by the CFTC, this term generally refers to any futures or option contract that is not based on an agricultural commodity or a natural resource. It includes currencies, equity securities, fixed income securities, and indexes of various kinds.

Financial Settlement: Cash settlement, especially for energy derivatives.

Floor Broker: A person with exchange trading privileges who, in any pit, ring, post, or other place provided by an exchange for the meeting of persons similarly engaged, executes for another person any orders for the purchase or sale of any commodity for future delivery.

Floor Trader: A person with exchange trading privileges who executes his own trades by being personally present in the pit or ring for futures trading. See Local.

Forwardation: See Contango.

Forward Contract: A cash transaction common in many industries, including commodity merchandising, in which a commercial buyer and seller agree upon delivery of a specified quality and quantity of goods at a specified future date. Terms may be more "personalized" than is the case with standardized futures contracts (i.e., delivery time and amount are as determined between seller and buyer). A price may be agreed upon in advance, or there may be agreement that the price will be determined at the time of delivery.

Forward Market: The over-the-counter market for forward contracts.

Forward Months: Futures contracts, currently trading, calling for later or distant delivery. See Deferred Futures, Back Months.

Front Month: The Spot or Nearby Delivery Month, the nearest traded contract month. See Back Month.

Front Running: With respect to commodity futures and options, taking a futures or option position based upon non-public information regarding an impending transaction by another person in the same or related future or option. Also known as trading ahead.

FRS: Financial Reporting System Survey (EIA survey).

Fuel switching capability: The short-term capability of a manufacturing establishment to have used substitute energy sources in place of those actually consumed. Capability to use substitute energy sources means that the establishment's combustors (for example, boilers, furnaces, ovens, and blast furnaces) had the machinery or equipment either in place or available for installation so that substitutions could actually have been introduced within 30 days without extensive modifications. Fuel-switching capability does not depend on the relative prices of energy sources; it depends only on the characteristics of the equipment and certain legal constraints.

Fundamental Analysis: Study of basic, underlying factors that will affect the supply and demand of the commodity being traded in futures contracts. See Technical Analysis.

Futures Contract: An agreement to purchase or sell a commodity for delivery in the future: (1) at a price that is determined at initiation of the contract; (2) that obligates each party to the contract to fulfill the contract at the specified price; (3) that is used to assume or shift price risk; and (4) that may be satisfied by delivery or offset.

Futures Price: (1) Commonly held to mean the price of a commodity for future delivery that is traded on a futures exchange; (2) the price of any futures contract.

Gas turbine plant: A plant in which the prime mover is a gas turbine. A gas turbine consists typically of an axial-flow air compressor and one or more combustion chambers where liquid or gaseous fuel is burned and the hot gases are passed to the turbine and where the hot gases expand drive the generator and are then used to run the compressor.

Grades: Various qualities of a commodity.

Haircut: In computing the value of assets for purposes of capital, segregation, or margin requirements, a percentage reduction from the stated value (e.g., book value or market value) to account for possible declines in value that may occur before assets can be liquidated.

Hedge Exemption: An exemption from speculative position limits for bona fide hedgers and certain other persons who meet the requirements of exchange and CFTC rules.

Hedge Fund: A private investment fund or pool that trades and invests in various assets such as securities, commodities, currency, and derivatives on behalf of its clients, typically wealthy individuals. Some Commodity Pool Operators operate hedge funds.

Hedging: Taking a position in a futures market opposite to a position held in the cash market to minimize the risk of financial loss from an adverse price change; or a purchase or sale of futures as a temporary substitute for a cash transaction that will occur later. One can hedge either a long cash market position (e.g., one owns the cash commodity) or a short cash market position (e.g., one plans on buying the cash commodity in the future).

Henry Hub: A natural gas pipeline hub in Louisiana that serves as the delivery point for New York Mercantile Exchange natural gas futures contracts and often serves as a benchmark for wholesale natural gas prices across the U.S.

Historical Volatility: A statistical measure of the volatility of a futures contract, security, or other instrument over a specified number of past trading days.

Implied Volatility: The volatility of a futures contract, security, or other instrument as implied by the prices of an option on that instrument, calculated using an options pricing model.

Instrument: A tradable asset such as a commodity, security, or derivative, or an index or value that underlies a derivative or could underlie a derivative.

Inverted Market: A futures market in which the nearer months are selling at prices higher than the more distant months; a market displaying "inverse carrying charges," characteristic of markets with supply shortages. See Backwardation.

Large Traders: A large trader is one who holds or controls a position in any one future or in any one option expiration series of a commodity on any one exchange equaling or exceeding the exchange or CFTC-specified reporting level.

Last Notice Day: The final day on which notices of intent to deliver on futures contracts may be issued.

Last Trading Day: Day on which trading ceases for the maturing (current) delivery month.

Leverage: The ability to control large dollar amounts of a commodity or security with a comparatively small amount of capital.

Limit (Up or Down): The maximum price advance or decline from the previous day's settlement price permitted during one trading session, as fixed by the rules of an exchange. In some futures contracts, the limit may be expanded or removed during a trading session a specified period of time after the contract is locked limit. See Daily Price Limit.

Limit Move: See Locked Limit.

Liquidation: The closing out of a long position. The term is sometimes used to denote closing out a short position, but this is more often referred to as covering. See Cover, Offset.

Liquid Market: A market in which selling and buying can be accomplished with minimal effect on price.

Local: An individual with exchange trading privileges who trades for his own account, traditionally on an exchange floor, and whose activities provide market liquidity. See Floor Trader, E-Local.

Long: (1) One who has bought a futures contract to establish a market position; (2) a market position that obligates the holder to take delivery; (3) one who owns an inventory of commodities. See Short.

Long Hedge: See Buying Hedge.

Manipulation: Any planned operation, transaction, or practice that causes or maintains an artificial price. Specific types include corners and squeezes as well as unusually large purchases or sales of a commodity or

security in a short period of time in order to distort prices, and putting out false information in order to distort prices.

Margin: The amount of money or collateral deposited by a customer with his broker, by a broker with a clearing member, or by a clearing member with a clearing organization. The margin is not partial payment on a purchase. Also called Performance Bond. (1) Initial margin is the amount of margin required by the broker when a futures position is opened; (2) Maintenance margin is an amount that must be maintained on deposit at all times. If the equity in a customer's account drops to or below the level of maintenance margin because of adverse price movement, the broker must issue a margin call to restore the customer's equity to the initial level. See Variation Margin. Exchanges specify levels of initial margin and maintenance margin for each futures contract, but Futures Commission Merchants may require their customers to post margin at higher levels than those specified by the exchange. Futures margin is determined by the SPAN margining system, which takes into account all positions in a customer's portfolio.

Market Maker: A professional securities dealer or person with trading privileges on an exchange who has an obligation to buy when there is an excess of sell orders and to sell when there is an excess of buy orders. By maintaining an offering price sufficiently higher than their buying price, these firms are compensated for the risk involved in allowing their inventory of securities to act as a buffer against temporary order imbalances. In the futures industry, this term is sometimes loosely used to refer to a floor trader or local who, in speculating for his own account, provides a market for commercial users of the market. Occasionally a futures exchange will compensate a person with exchange trading privileges to take on the obligations of a market maker to enhance liquidity in a newly listed or lightly traded futures contract. See Specialist System.

Mark-to-Market: Part of the daily cash flow system used by US futures exchanges to maintain a minimum level of margin equity for a given futures or option contract position by calculating the gain or loss in each contract position resulting from changes in the price of the futures or option contracts at the end of each trading session. These amounts are added or subtracted to each account balance.

Maturity: Period within which a futures contract can be settled by delivery of the actual commodity.

Mcf: One thousand cubic feet.

Methane: A colorless, flammable, odorless hydrocarbon gas (CH_4) which is the major component of natural gas. It is also an important source of hydrogen in various industrial processes. Methane is a greenhouse gas. See also **Greenhouse gases**.

MMbbl/d: One million barrels of oil per day.

MMBtu: One million British thermal units.

MMcf: One million cubic feet.

Narrow-Based Security Index: In general, the Commodity Exchange Act defines a narrow-based security index as an index of securities that meets one of the following four requirements (1) it has nine or fewer components; (2) one component comprises more than 30 percent of the index weighting; (3) the five highest weighted components comprise more than 60 percent of the index weighting, or (4) the lowest weighted components comprising in the aggregate 25 percent of the index's weighting have an aggregate dollar value of average daily volume over a six-month period of less than $50 million ($30 million if there are at least 15 component securities). However, the legal definition in Section 1a(25) of the CEA contains several exceptions to this provision. See Broad-Based Security Index, Security Future.

National Futures Association (NFA): A self-regulatory organization whose members include Futures Commission Merchants, Commodity Pool Operators, Commodity Trading Advisors, Introducing Brokers, commodity exchanges, commercial firms, and banks, that is responsible—under CFTC oversight—for certain aspects of the regulation of FCMs, CPOs, CTAs, IBs, and their Associated Persons, focusing primarily on the qualifications and proficiency, financial condition, retail sales practices, and business

conduct of these futures professionals. NFA also performs arbitration and dispute resolution functions for industry participants.

Nearbys: The nearest delivery months of a commodity futures market.

Nearby Delivery Month: The month of the futures contract closest to maturity; the front month or lead month.

Net Position: The difference between the open long contracts and the open short contracts held by a trader in any one commodity.

NYMEX: the New York Mercantile Exchange (NYMEX).

NYMEX Swap: A lookalike swap that is based on a futures contract traded on the New York

Off Exchange: See Over-the-Counter.

Off peak gas: Gas that is to be delivered and taken on demand when demand is not at its peak.

On peak: Periods of relatively high system demand. These periods often occur in daily, weekly, and seasonal patterns; these on-peak periods differ for each individual electric utility.

Opening Price (or Range): The price (or price range) recorded during the period designated by the exchange as the official opening.

Opening: The period at the beginning of the trading session officially designated by the exchange during which all transactions are considered made "at the opening."

Open Interest: The total number of futures contracts long or short in a delivery month or market that has been entered into and not yet liquidated by an offsetting transaction or fulfilled by delivery. Also called Open Contracts or Open Commitments.

Option: A contract that gives the buyer the right, but not the obligation, to buy or sell a specified quantity of a commodity or other instrument at a specific price within a specified period of time, regardless of the market price of that instrument. Also see Put and Call.

Over-the-Counter (OTC): The trading of commodities, contracts, or other instruments not listed on any exchange. OTC transactions can occur electronically or over the telephone. Also referred to as Off-Exchange.

Pork Bellies: One of the major cuts of the hog carcass that, when cured, becomes bacon.

Position: An interest in the market, either long or short, in the form of one or more open contracts.

Position Limit: See Speculative Position Limit.

Prearranged Trading: Trading between brokers in accordance with an expressed or implied agreement or understanding, which is a violation of the Commodity Exchange Act and CFTC regulations.

Price Discovery: The process of determining the price level for a commodity based on supply and demand conditions. Price discovery may occur in a futures market or cash market.

Price Movement Limit: See Limit (Up or Down).

Primary Market: (1) For producers, their major purchaser of commodities; (2) to processors, the market that is the major supplier of their commodity needs; and (3) in commercial marketing channels, an important center at which spot commodities are concentrated for shipment to terminal markets.

Probable energy reserves: Estimated quantities of energy sources that, on the basis of geologic evidence that supports projections from proved reserves (see definition below), can reasonably be expected to exist and be recoverable under existing economic and operating conditions. Site information is insufficient to establish with confidence the location, quality, and grades of the energy source. Note: This term is equivalent to "Indicated Reserves" as defined in the resource/reserve classification contained in the U.S.

Geological Survey Circular 831, 1980. Measured and indicated reserves, when combined, constitute demonstrated reserves.

Production capacity: The amount of product that can be produced from processing facilities.

Program Trading: The purchase (or sale) of a large number of stocks contained in or comprising a portfolio. Originally called program trading when index funds and other institutional investors began to embark on large-scale buying or selling campaigns or "programs" to invest in a manner that replicates a target stock index, the term now also commonly includes computer-aided stock market buying or selling programs, and index arbitrage.

Prompt Date: The date on which the buyer of an option will buy or sell the underlying commodity (or futures contract) if the option is exercised.

Proved energy reserves: Estimated quantities of energy sources that analysis of geologic and engineering data demonstrates with reasonable certainty are recoverable under existing economic and operating conditions. The location, quantity, and grade of the energy source are usually considered to be well established in such reserves. *Note:* This term is equivalent to "Measured Reserves" as defined in the resource/reserve classification contained in the U.S. Geological Survey Circular 831, 1980. Measured and indicated reserves, when combined, constitute demonstrated reserves.

Public: In trade parlance, non-professional speculators as distinguished from hedgers and professional speculators or traders.

Public utility: Enterprise providing essential public services, such as electric, gas, telephone, water, and sewer under legally established monopoly conditions.

Quotation: The actual price or the bid or ask price of either cash commodities or futures contracts.

Rally: An upward movement of prices.

Random Walk: An economic theory that market price movements move randomly. This assumes an efficient market. The theory also assumes that new information comes to the market randomly. Together, the two assumptions imply that market prices move randomly as new information is incorporated into market prices. The theory implies that the best predictor of future prices is the current price, and that past prices are not a reliable indicator of future prices. If the random walk theory is correct, Technical Analysis cannot work.

Recoverable proved reserves: The proved reserves of natural gas as of December 31 of any given year are the estimated quantities of natural gas which geological and engineering data demonstrates with reasonable certainty to be recoverable in the future from known natural oil and gas reservoirs under existing economic and operating conditions.

Recoverable reserves: The amount of coal that can be recovered (mined) from the coal deposits at active producing mines as of the end of the year.

Reporting Level: Sizes of positions set by the exchanges and/or the CFTC at or above which commodity traders or brokers who carry these accounts must make daily reports about the size of the position by commodity, by delivery month, and whether the position is controlled by a commercial or non-commercial trader. See CFTC Backgrounder: The CFTC's Large Trader Reporting System.

Reserve: That portion of the demonstrated reserve base that is estimated to be recoverable at the time of determination. The reserve is derived by applying a recovery factor to that component of the identified coal resource designated as the demonstrated reserve base.

Reserve additions: The estimated original, recoverable, salable, and new proved reserves credited to new fields, new reservoirs, new gas purchase contracts, amendments to old gas purchase contracts, or purchase of gas reserves in-place that occurred during the year and had not been previously reported. Reserve additions refer to domestic in-the-ground natural gas reserve additions and do not refer to interstate pipeline purchase agreements; contracts with foreign suppliers; coal gas, SNG, or LNG purchase arrangements.

Risk/Reward Ratio: The relationship between the probability of loss and profit. This ratio is often used as a basis for trade selection or comparison.

Roll-Over: A trading procedure involving the shift of one month of a straddle into another future month while holding the other contract month. The shift can take place in either the long or short straddle month. The term also applies to lifting a near futures position and re-establishing it in a more deferred delivery month.

Rotary rig: A machine used for drilling wells that employs a rotating tube attached to a bit for boring holes through rock.

Round Trip Trading: See Wash Trading.

Rules: The principles for governing an exchange. In some exchanges, rules are adopted by a vote of the membership, while in others, they can be imposed by the governing board.

Securities and Exchange Commission (SEC): The Federal regulatory agency established in 1934 to administer Federal securities laws.

Self-Regulatory Organization (SRO): Exchanges and registered futures associations that enforce financial and sales practice requirements for their members. See Designated Self-Regulatory Organizations.

Short: (1) The selling side of an open futures contract; (2) a trader whose net position in the futures market shows an excess of open sales over open purchases. See Long.

Short Covering: See Cover.

Short Hedge: See Selling Hedge.

Short Selling: Selling a futures contract or other instrument with the idea of delivering on it or offsetting it at a later date.

Short Squeeze: See Squeeze.

Shut in: Closed temporarily; wells and mines capable of production may be shut in for repair, cleaning, inaccessibility to a market, etc.

Small Traders: Traders who hold or control positions in futures or options that are below the reporting level specified by the exchange or the CFTC.

Soft: (1) A description of a price that is gradually weakening; or (2) this term also refers to certain “soft” commodities such as sugar, cocoa, and coffee.

Spark Spread: The differential between the price of electricity and the price of natural gas or other fuel used to generate electricity, expressed in equivalent units. See Gross Processing Margin.

Speculator: In commodity futures, an individual who does not hedge, but who trades with the objective of achieving profits through the successful anticipation of price movements.

Spot: Market of immediate delivery of and payment for the product.

Spot Commodity: (1) The actual commodity as distinguished from a futures contract; (2) sometimes used to refer to cash commodities available for immediate delivery. See Actuals or Cash Commodity.

Spot market (natural gas): A market in which natural gas is bought and sold for immediate or very near-term delivery, usually for a period of 30 days or less. The transaction does not imply a continuing arrangement between the buyer and the seller. A spot market is more likely to develop at a location with numerous pipeline interconnections, thus allowing for a large number of buyers and sellers. The Henry Hub in southern Louisiana is the best known spot market for natural gas.

Spot Month: The futures contract that matures and becomes deliverable during the present month. Also called Current Delivery Month.

Spot Price: The price at which a physical commodity for immediate delivery is selling at a given time and place. See Cash Price.

Spread (or Straddle): The purchase of one futures delivery month against the sale of another futures delivery month of the same commodity; the purchase of one delivery month of one commodity against the sale of that same delivery month of a different commodity; or the purchase of one commodity in one market against the sale of the commodity in another market, to take advantage of a profit from a change in price relationships. The term spread is also used to refer to the difference between the price of a futures month and the price of another month of the same commodity. A spread can also apply to options. See Arbitrage.

Squeeze: A market situation in which the lack of supplies tends to force shorts to cover their positions by offset at higher prices. Also see Congestion, Corner.

Straddle: (1) See Spread; (2) an option position consisting of the purchase of put and call options having the same expiration date and strike price.

Storage additions: Volumes of gas injected or otherwise added to underground natural gas reservoirs or liquefied natural gas storage.

Storage withdrawals: Total volume of gas withdrawn from underground storage or from liquefied natural gas storage over a specified amount of time.

STRIPS (Separate Trading of Registered Interest and Principal Securities): A book-entry system operated by the Federal Reserve permitting separate trading and ownership of the principal and coupon portions of selected Treasury securities. It allows the creation of zero coupon Treasury securities from designated whole bonds.

Strong Hands: When used in connection with delivery of commodities on futures contracts, the term usually means that the party receiving the delivery notice probably will take delivery and retain ownership of the commodity; when used in connection with futures positions, the term usually means positions held by trade interests or well-financed speculators.

Sunk cost: Part of the capital costs actually incurred up to the date of reserves estimation minus depreciation and amortization expenses. Items such as exploration costs, land acquisition costs, and costs of financing can be included.

Swap: In general, the exchange of one asset or liability for a similar asset or liability for the purpose of lengthening or shortening maturities, or raising or lowering coupon rates, to maximize revenue or minimize financing costs. This may entail selling one securities issue and buying another in foreign currency; it may entail buying a currency on the spot market and simultaneously selling it forward. Swaps also may involve exchanging income flows; for example, exchanging the fixed rate coupon stream of a bond for a variable rate payment stream, or vice versa, while not swapping the principal component of the bond. Swaps are generally traded over-the-counter.

Systematic Risk: Market risk due to factors that cannot be eliminated by diversification.

Systemic Risk: The risk that a default by one market participant will have repercussions on other participants due to the interlocking nature of financial markets. For example, Customer A's default in X market may affect Intermediary B's ability to fulfill its obligations in Markets X, Y, and Z.

Technical Analysis: An approach to forecasting commodity prices that examines patterns of price change, rates of change, and changes in volume of trading and open interest, without regard to underlying fundamental market factors. Technical analysis can work consistently only if the theory that price movements are a Random Walk is incorrect. See Fundamental Analysis.

Trader: (1) A merchant involved in cash commodities; (2) a professional speculator who trades for his own account and who typically holds exchange trading privileges.

Trading Ahead: See Front Running.

Transaction: The entry or liquidation of a trade.

Underlying Commodity: The cash commodity underlying a futures contract. Also, the commodity or futures contract on which a commodity option is based, and which must be accepted or delivered if the option is exercised.

Volatility: A statistical measurement of the rate of price change of a futures contract, security, or other instrument underlying an option. See Historical Volatility, Implied Volatility.

Volume of Trade: The number of contracts traded during a specified period of time. It may be quoted as the number of contracts traded or as the total of physical units, such as bales or bushels, pounds or dozens.

Wash Sale: See Wash Trading.

Wash Trading: Entering into, or purporting to enter into, transactions to give the appearance that purchases and sales have been made, without incurring market risk or changing the trader's market position. The Commodity Exchange Act prohibits wash trading. Also called Round Trip Trading, Wash Sales.

Weather Derivative: A derivative whose payoff is based on a specified weather event, for example, the average temperature in Chicago in January. Such a derivative can be used to hedge risks related to the demand for heating fuel or electricity.

Wellhead: The point at which the crude (and/or natural gas) exits the ground. Following historical precedent, the volume and price for crude oil production are labeled as "wellhead," even though the cost and volume are now generally measured at the lease boundry. In the context of domestic crude price data, the term "wellhead" is the generic term used to reference the production site or lease property.

Wellhead price: The value at the mouth of the well. In general, the wellhead price is considered to be the sales price obtainable from a third party in an arm's length transaction. Posted prices, requested prices, or prices as defined by lease agreements, contracts, or tax regulations should be used where applicable.

Yield Curve: A graphic representation of market yield for a fixed income security plotted against the maturity of the security. The yield curve is positive when long-term rates are higher than short-term rates.

Yield to Maturity: The rate of return an investor receives if a fixed income security is held to maturity.